IMCA International Code of Practice for Offshore Diving

International Marine Contractors Association

www.imca-int.com

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November 2019

The International Marine Contractors Association (IMCA) is the international trade association representing offshore, marine and underwater engineering companies.

IMCA promotes improvements in quality, health, safety, environmental and technical standards through the publication of information notes, codes of practice and other documentation.

Members are self-regulating through the adoption of IMCA guidelines as appropriate. They commit to act as responsible members by following relevant guidelines and being willing to be audited against compliance with them.

There are five core committees that relate to all members:

- Competence & Training
- Contracts & Insurance
- Health, Safety, Security & Environment
- Lifting & Rigging
- Marine Policy & Regulatory Affairs

The Association is organised through four distinct divisions, each covering a specific area of members' interests – Diving, Marine, Offshore Survey and Remote Systems & ROV.

There are also five regions which facilitate work on issues affecting members in their local geographic area – Asia-Pacific, Europe & Africa, Middle East & India, North America and South America.

IMCA D 014 Rev. 2.1

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Date	**Reason**	**Revision**
April 1998	Initial publication	
October 2007	Updated to incorporate changed operating practices since first publication	Rev.1
February 2014	Updated to incorporate changed operating practices	Rev. 2
November 2019	Updated to incorporate changes to Section 7.3.2 Surface Swimmers	Rev. 2.1

IMCA International Code of Practice for Offshore Diving

IMCA D 014 Rev. 2.1 – November 2019

1 Introduction

1.1 General

The offshore commercial diving industry, while providing services to the oil & gas and renewable/ alternative energy industries, can be the subject of various regulations, standards, codes and guidelines imposed by national governments of a particular area, the clients who wish the work to be carried out, the insurers of the diving contractor or other outside organisations, societies, advisory committees and associations.

While offshore diving in some areas is heavily regulated, there are other areas where there may be little or no outside control of diving activities. In such areas the diving contractors themselves are left to establish their own internal controls by means of their company manuals and procedures.

In the absence of local regulations there can be instances where some clients attempt to impose the regulatory standards of another area. This can cause confusion as many national regulations are based on local environmental and social conditions which simply may not apply in other parts of the world.

The document is intended to assist among others:

- personnel involved in diving operations;
- clients' staff involved in the preparation of bid documents and contracts;
- client and diving contractor representatives;
- vessel owners and marine crews involved with diving operations;
- installation and rig managers using divers;
- all personnel involved in operational management;
- all personnel involved in quality assurance and health, safety and environment.

IMCA has included recommendations in areas where there is a difficult balance between commercial considerations and health, security, safety and environmental implications, which should not be compromised for any reason.

In particular, there is a need for clients and contractors to recognise and accept the importance of providing:

- sufficient and appropriately qualified and competent personnel to conduct operations safely at all times;
- safe, fit-for-purpose and properly maintained equipment;
- adequate time for routine preventative maintenance;
- adequate time for personnel to become familiar with, amongst others:
  - work location
  - equipment they have to work with
  - relevant operational and emergency procedures and manuals
  - risk assessments
  - underwater work and reporting procedures;
- adequate time for emergency exercises.

In order to provide a 'level playing field' for diving contractors, this code of practice seeks to lay down minimum requirements which all IMCA members world-wide should comply with (see also section 1.4).

1.2 Scope of the Code

The IMCA International Code of Practice for Offshore Diving offers examples of good practice, gives advice on ways in which diving operations can be carried out safely and efficiently and includes personnel, equipment and systems guidelines for the following diving operations:

- surface supplied diving using:
  - air
  - nitrox
  - mixed gas;
- closed bell diving;
- saturation diving.

1.3 Status of the Code

This code:

- has no direct legal status but many courts, in the absence of specific local regulations, would accept that a company carrying out diving operations in line with the recommendations of this code was using safe and accepted practices;
- is not meant to be a substitute for company manuals and procedures.

1.4 Work Covered by the Code

This code is intended to provide advice and guidance in respect of all diving operations carried out anywhere in the world being:

- outside the territorial waters of a country (normally 12 miles or 19.25 kilometres from shore);
- inside territorial waters where offshore diving, normally in support of the oil & gas or renewable/ alternative energy industries is being carried out. Specifically excluded are diving operations being conducted in support of civil, inland, inshore or harbour works or in any case where operations are not conducted from an offshore structure, vessel or floating structure normally associated with offshore oil & gas or renewable/alternative energy industry activities.

1.5 Regulations, Standards, Codes, Rules and Guidelines

1.5.1 National

A number of countries in the world have national regulations, codes and/or standards which apply to:

- offshore diving operations taking place within waters controlled by that country;
- vessels and floating structures registered in that country (flag state).

In case the national regulations, codes and/or standards are more stringent than this code they must take precedence over this code and the contents of this code should only be used where they do not conflict with the relevant national regulations, codes and/or standards.

1.5.2 International

There are also international regulations, codes and standards (such as those of the International Maritime Organization (IMO)) which apply to offshore diving operations that diving contractors need to be aware of.

1.5.3 Industry

Diving contractors need to be aware of industry guidance, related to diving operations. This includes guidance issued by the International Association of Oil & Gas Producers (OGP) and the Diving Medical Advisory Committee (DMAC).

1.5.4 Classification Societies

Classification societies have standards, rules and regulations for diving equipment, which include design, construction, modifications, initial and periodic testing of each item of plant or equipment, failure modes and effects analysis (FMEA), certification and classification.

National regulations, clients, insurers or others may require diving systems to be certified or classed by a classification society and an FMEA/FMECA (failure mode effects and criticality analysis) to be carried out.

1.5.5 Clients

Clients may also have their own guidelines that diving contractors need to be aware of.

1.6 Diving Management System (DMS)

Diving contractors covered by this code should have a diving management system (DMS), which should contain the management of health, security, safety, environment and quality as a part of the overall company management system (see section 3.1 and Appendix 1 for details).

1.7 Diving Project Plan (DPP)

Diving contractors should, before commencement of a diving project, prepare a project specific diving project plan (DPP), in consultation with their client (see section 7.1 for details).

1.8 Updating Arrangements

This code is a dynamic document and the advice given in it will change with developments in the industry. It is intended that this code shall be periodically reviewed and any necessary changes or improvements made.

2 Glossary of Terms

A number of specialised terms are used in this document. It is assumed that readers are familiar with most of them. However, a number of them, although in use for many years, could be misunderstood. These terms are defined below to ensure that readers understand what is meant by them in this document.

ALST	Assistant life support technician
Certification	A document that confirms that a particular test or examination has been carried out or witnessed at an identified time on a specific piece of equipment or system by a competent person
Classification	A diving system built in accordance with a classification society's own rules can, at the owner's request, be assigned a class
Company medical adviser	A nominated diving medical specialist appointed by a diving contractor to provide specialist advice
Competent	Having sufficient training or experience (or a combination of both) to be capable of carrying out a task safely and efficiently
DCI	Decompression illness
DDC	Deck decompression chamber. A pressure vessel for human occupancy which does not go under water and may be used as a living chamber during saturation diving, diver decompression or treatment of decompression illness. Also called compression chamber, recompression chamber, deck chamber or surface compression chamber
DESIGN	Diving Equipment Systems Inspection Guidance Note
Dive plan	A plan prepared for each dive or series of dives to brief the diver(s) about the work to be undertaken including the necessary safety precautions to be taken
Diving basket	A diver deployment device normally designed with an open cage as defined in section 5 of IMCA D 023
Diving bell	A pressure vessel for human occupancy which is used to transport divers under pressure either to or from the underwater worksite. Also called closed diving bell or submersible decompression chamber
Diving medical specialist	A doctor (diving medicine physician) who is competent to manage the treatment of diving accidents, including, where appropriate, mixed gas and saturation diving accidents. Such a doctor will have undergone specialised training and have demonstrated experience in this field
Diving system	The whole plant and equipment for the conduct of diving operations
DMAC	Diving Medical Advisory Committee
DMS	Diving management system
DP	Dynamic positioning. A system that automatically controls a vessel's position and heading by means of thrusters. A typical DP system consists of a control system (including power management and position control), reference systems (such as position, heading and environmental references) and power systems (including power generation, distribution and consumption)
DPO	DP operator. This is an individual who operates the dynamic positioning system
DPP	Diving project plan. Documents and information available on-site at a diving project and should include mobilisation and demobilisation plans, the diving technique/procedures to be used, step-by-step diver work procedures, identification of hazards and control and contingency procedures for any foreseeable emergency

DSV	Diving support vessel
EAD	Equivalent air depth
Fixed diving system	A diving system installed permanently on a vessel or fixed/floating structure
FMEA	Failure modes and effects analysis. This is a methodology used to identify potential failure modes, determine their effects and identify actions to mitigate the failures
FMECA	Failure mode effects and criticality analysis. This is an extension of the FMEA. In addition to the basic FMEA, it includes a criticality analysis, which is used to chart the probability of failure modes against the severity of their consequences. The result highlights failure modes with relatively high probability and severity of consequences, allowing remedial effort to be directed where it will produce the greatest effect
FPSO	Floating production storage and offloading
Habitat	An underwater structure inside which divers can carry out dry welding and which is fitted out with life support facilities
HAZID	Hazard identification
HAZOP	Hazard and operability study
Heliox	A breathing mixture of helium and oxygen
HES	Hyperbaric evacuation system. This term covers the whole system set up to provide hyperbaric evacuation. It includes the planning, procedures, actual means of evacuation, reception facility, contingency plans, possible safe havens and anything else involved in a successful hyperbaric evacuation
HIRA	Hazard identification and risk assessment
HPR	Hydroacoustic positioning reference
HRC	Hyperbaric rescue chamber. Normally a pressure vessel adapted to act as a means of hyperbaric evacuation but not fitted inside a conventional lifeboat hull
HRF	Hyperbaric reception facility. Normally a shore based facility, however could also be installed offshore depending on the distance to the shore, which is capable of accepting an HRC or an SPHL and mating it to another chamber such that the evacuated occupants can be transferred in to that chamber and safely decompressed
HRU	Hyperbaric rescue unit. The term used for the unit to evacuate the divers away from the saturation system. This may be an HRC or a SPHL or some other pressure vessel Note: May also be known as hyperbaric evacuation unit (HEU)
IMO	International Maritime Organization
ISM	International Safety Management (ISM) Code, issued by IMO
ISO	International Organization for Standardization
ISPS	International Ship and Port Facility Security (ISPS) Code, issued by IMO
JSA	Job safety analysis. Also called safe job analysis (SJA), job hazard analysis (JHA), task risk assessment (TRA)
Lift bag	A bag which is filled with air or gas to provide uplift to an underwater object. Often used for lifting purposes by divers
Lock-off time	The time at which a diving bell under pressure is disconnected from the compression chamber(s) on deck

Lock-on time	The time at which a diving bell under pressure is reconnected to the compression chamber(s) on deck
LSA	Low specific activity. LSA scale is a radioactive deposit inside pipes and other production equipment. LSA scale is a type of NORM
LSP	Life support package. A collection of equipment and supplies kept in a suitable location such that when the HRC or SPHL arrives at the safe haven it can carry out (or complete) decompression using the LSP components externally to maintain the environment, power, gas mixtures, heating and cooling. This system will take over from or supplement any such equipment or services already mounted on the HRU Note: This may be known by other names such as 'fly-away package'
LSS	Life support supervisor
LST	Life support technician
Medical examiner of divers	A doctor who is trained and competent to perform the annual assessment of fitness to dive for divers. Medical examiners of divers may not possess knowledge of the treatment of diving accidents
MoC	Management of change. This is a process that needs to take place to revise an existing approved design/fabrication or work/installation procedure
NDT	Non-destructive testing
Nitrox	A breathing mixture of nitrogen and oxygen
NORM	Naturally occurring radioactive material
OGP	International Association of Oil & Gas Producers
PLC	Programmable logic controller. This is a microcomputer embedded in or attached to a device to perform switching, timing, or machine or process control tasks
PMS	Planned maintenance system
Portable diving system	Portable – also known as mobile – diving system. This is a diving system which is installed on a vessel or installation on a temporary basis, although this may be for a reasonably long period of time. It will often be situated on an open deck and is installed in such a way that would make it relatively easy to remove it to a different location or vessel
PPE	Personal protective equipment
Reception site	A place where the evacuated divers are in safe environmental conditions and transfer can be made to a decompression facility or where decompression can be carried out (or completed) in the HRC or SPHL using external life support facilities (LSP). Typical examples would be: ♦ A vessel, fixed or floating platform or barge with LSP and life support personnel on board plus the ability to lift the HRC or SPHL on board; ♦ Portable HRF or full land based HRF with all necessary facilities and personnel; ♦ Land based location (quayside, dock, etc.) with LSP and life support personnel present
Risk assessment	The process by which every reasonably foreseeable risk is evaluated and assessed. As part of the process, control measures to be established to prevent harm before an operation commences should be identified. The findings and actions will be documented. A risk assessment is part of the risk management process

ROV	Remotely operated vehicle
Safe haven	A place where the HRU can be initially taken as part of the evacuation plan. It may also be a reception site or it may be an intermediate stop on the way to a reception site
SCUBA	Self-contained underwater breathing apparatus
SIMOPS	Simultaneous operations
Simulator	A simulator can be defined as the creation of certain conditions by means of a model, to simulate conditions within the appropriate sphere of conditions
SMS	Safety management system
SPHL	Self-propelled hyperbaric lifeboat. Normally a custom designed unit of a pressure vessel contained within a conventional lifeboat hull having equipment to provide suitable life support to the evacuated divers for an extended period. The unit normally has motive power and a small crew at atmospheric pressure to navigate and steer the unit as well as monitoring the divers inside the pressure vessel Note: May also be known as hyperbaric lifeboat (HLB) or hyperbaric rescue vessel (HRV)
Standby diver	A diver other than the working diver(s) who is dressed and with equipment immediately available to provide assistance to the working diver(s) in an emergency
SWL	Safe working load (see WLL/SWL below)
Toolbox talk	A meeting held at the start of each shift or prior to any project critical operation, where the diving supervisor and/or the diving supervisor's delegate and shift personnel discuss the forthcoming tasks or jobs and the potential risks and necessary precautions to be taken
VOC	Volatile organic compound
Wet bell	A diving basket fitted with a dome is not a wet bell. A wet bell requires a dome and main supply umbilical from the surface providing (as a minimum) breathing gas to a manifold inside the wet bell and diver excursion umbilicals terminated at the wet bell
WLL/SWL	Working load limit/safe working load. WLL is the ultimate permissible load, assigned by the manufacturer of the item. The SWL may be the same as the WLL but may be of a lower value assigned by an independent competent person taking account of particular service conditions

3 Duties, Roles and Responsibilities

3.1 Diving Contractor

On any diving project there needs to be one company in overall control of the diving operations. This will normally be the company who employs the divers. If there is more than one company employing divers then there will need to be a written agreement as to which of these companies is in overall control.

The company in control is called the diving contractor. The name of the diving contractor should be clearly displayed and all personnel, clients and others involved in the diving operation should be aware who the diving contractor is.

The diving contractor will need to define a management structure in writing. This should include arrangements for a clear handover of supervisory responsibilities at appropriate stages in the operation, again recorded in writing.

The diving contractor's responsibilities are to provide a safe system of work to carry out the diving activity and comply with the applicable national legislation. This includes the following:

- a diving management system (DMS), which should contain the management of health, security, safety, environmental and quality as a part of the overall company management system. This should follow the principles of ISO 9001 and related standards. Appendix 1 should be considered as a guideline for the DMS as applicable to the contractors operations;
- a diving project plan for a specific project;
- appropriate insurance policies which should include third party liability and appropriate medical insurance cover for all dive team members;
- risk assessments for mobilisation/demobilisation, the operation of the equipment and work tasks to be undertaken and the contingency/emergency plans;
- a management of change (MoC) procedure;
- a safe and suitable place from which operations are to be carried out;
- suitable plant and equipment supplied, audited and certified in accordance with the relevant IMCA DESIGN documents, other Diving-, Marine-, Offshore Survey- and Remote Systems & ROV Division guidance notes and IMO documents, including equipment supplied by diving personnel;
- plant and equipment correctly and properly maintained;
- emergency and contingency plans and procedures;
- sufficient personnel of the required grades in the diving team;
- Personnel holding valid medical and training certificates and qualified and competent in accordance with the IMCA competence assurance and assessment guidance documents and competence tables;
- suitable site-specific safety and familiarisation training provided to all members of the dive team, rigging personnel, vessel personnel including the crane driver and ROV team (when applicable);
- adequate arrangements to ensure that the supervisor and dive team are fully briefed on the project and aware of the content of the diving project plan and the dive plan;
- project records kept of all relevant details of the project, including all dives;
- a procedure for near miss and incidents/accidents reporting, investigation and follow up;
- adequate arrangements for first aid and medical treatment of personnel;
- clear reporting and responsibility structure laid out in writing;
- diving supervisors and life support supervisors appointed in writing and the extent of their control documented;
- the latest approved version of the diving contractor documents and plans at the worksite and being used;

- all relevant regulations/standards are complied with.

The level of detail or involvement required of the diving contractor, and information on how to meet the responsibilities, are given in the relevant sections of this code.

The guidelines and standards referred to in this code may be updated from time to time and the diving contractor should make sure the latest version of the guidelines and standards are being used.

3.2 Clients and Others

The actions of others can have a bearing on the safety of the diving operation even though they are not members of the team. These others include:

1) The client who has placed a contract with a diving contractor for a project. The client will usually be the operator or owner of a proposed or existing installation, control umbilicals, power cables, wellheads or pipelines where diving work is going to take place, or a contractor acting on behalf of the operator or owner. If the operator or owner appoints an on-site representative then such a person should have the necessary experience and knowledge to be competent for this task (*Ref. information note IMCA TCPC 12/04, OGP Report No. 431*);
2) The main contractor carrying out work for the client and overseeing the work of the diving contractor according to the contract. If the main contractor appoints an on-site representative then such a person should have the necessary experience and knowledge to be competent for this task (*Ref. information note IMCA TCPC 12/04, OGP Report No. 431*);
3) The installation or offshore manager who is responsible for the area inside which diving work is to take place;
4) The master of a vessel (or floating structure) from which diving work is to take place who controls the vessel and who has overall responsibility for the safety of the vessel and all personnel on it;
5) The DP operator (DPO) who is the responsible person on the DP control panel on a DP vessel/ floating structure or the duty officer on an anchored DSV or floating structure. The DPO or duty officer will need to inform the diving supervisor of any possible change in position-keeping ability as soon as it is known.

These organisations or personnel will need to consider carefully the actions required of them. Their duties should include:

- agreeing to provide facilities and information for hyperbaric rescue of divers and extend all reasonable support to the diving supervisor or contractor in the event of an emergency, including:

  Saturation diving (see also section 8)

  - a suitable location(s) for installing a life support package (LSP)
  - a suitable location for a hyperbaric reception facility (HRF) and lifting facilities
  - floating or fixed installation and/or vessels information such as:
    - cranes capable and which could be available to lift the hyperbaric rescue unit (HRU) out of the water onto the deck
    - power and water supply, deck space and accommodation availability
  - diving support vessel(s) and floating or fixed structures with saturation diving equipment, which could be available to assist in an emergency
  - vessels capable and which could be available for towing an HRU
  - information about port facilities, such as cranes, which could be made available for reception/ lifting of the HRU
  - information about land transport availability for transport of an HRU and HRF
  - information about helicopter(s) which could be made available for transport of equipment, diving and medical personnel in an emergency
  - provision of medical support;
- Surface supplied diving (see also section 9)
  - availability of recompression facilities for decompression of diver(s) from a stricken floating or fixed installation and/or vessel, with omitted decompression;

- details of the matters agreed should form part of the planning for the project specific emergency and hyperbaric evacuation procedures, which form part of the diving project plan (see also section 8);
- considering whether any underwater or above-water items of plant or equipment under their control may cause a hazard to the diving team. Such items include:
  - vessel/floating structure propellers and anchor wires
  - underwater obstructions
  - pipeline systems under pressure test or with a pressure lower than the pressure at the diver work location
  - subsea facilities
  - water intakes or discharge points causing suction or turbulence
  - gas flare mechanisms that may activate without warning
  - equipment liable to start operating automatically
  - appropriate isolations and barriers (mechanical, electrical, optical, hydraulic, instrumentation, isolations and barriers)

The diving contractor will need to be informed of the location and exact operational details of such items in writing and in sufficient time to account for them in the risk assessments;

- ensuring that:
  - sufficient time and facilities are made available to the diving contractor at the commencement of the project in order to carry out all necessary site-specific safety and familiarisation training
  - other activities in the vicinity do not affect the safety of the diving operation, for example SIMOPS. They may, for example, need to arrange for the suspension of supply boat unloading, overhead scaffolding work, seismic operations, etc.
  - a formal control system, for example, a permit to work system, exists between the diving team, the installation manager and/or the master and that relevant contractor personnel are suitably trained;
- providing the diving contractor with:
  - details and risk assessments of any possible substance likely to be encountered by the diving team that could be a hazard to their health , e.g.:
    - drill cuttings on the seabed
    - contaminated effluent
    - chemicals and petroleum products
    - hydrogen sulphide (H_2S)
  - information about any impressed current system on the worksite or in the vicinity and details of the system
  - radiation sources e.g. NORM, details and risk assessments

The above information should be provided in writing and in sufficient time to allow the diving contractor to carry out the relevant risk assessments;

- keeping the diving supervisor informed of any changes that may affect the diving operation, e.g. vessel movements, deteriorating weather, helicopter operations, etc.

3.3 Offshore Manager

Where the diving contractor has provided an offshore manager, then the offshore manager is the diving contractor's representative at the worksite and is generally appointed on larger projects. Offshore managers have overall responsibility for the project execution and their responsibilities and tasks include:

- ensuring that activities are carried out in accordance with the requirements in the diving project plan and the applicable laws and regulations;
- ensuring that personnel are competent, qualified and familiar with the work procedures, safety precautions to be taken, laws and regulations and IMCA guidance and information notes.

The offshore manager will normally be the primary contact point offshore with the client. The offshore manager may or may not have a diving background.

3.4 Diving Superintendent

With a large diving team working continuously around the clock it will be necessary to appoint a minimum of two diving supervisors. In addition a diving superintendent, who will be an experienced diving supervisor and who may also act as the offshore project manager, should also be appointed. He should co-ordinate the work of both shifts of divers.

If an offshore manager has not been appointed then the diving superintendent is the diving contractor's representative at the worksite. Diving superintendents are responsible for and competent (*Ref. IMCA C 003*) to manage the overall diving operation and their responsibilities, tasks and duties should include:

- ensuring the activities are carried out in accordance with the requirements in the diving project plan and the applicable laws and regulations;
- ensuring the personnel are competent and qualified and familiar with the work procedures, safety precautions to be taken, laws and regulations and IMCA guidance and information notes.

For a diving superintendent to act as a diving supervisor he should be appropriately trained and certified and be in possession of a letter of appointment.

3.5 Diving Supervisor

Supervisors are appointed by the diving contractor in writing and are responsible for the operation that they have been appointed to supervise. Unless an offshore manager or diving superintendent has been provided by the diving contractor then the diving supervisor is the diving contractor's representative at the worksite. A diving supervisor should only hand over control to another supervisor appointed in writing by the diving contractor. Such a handover will need to be entered in the relevant operations logbook.

Supervisors can only supervise as much of a diving operation as they can personally control, both during routine operations and if an emergency should occur.

The supervisor with responsibility for the operation is the only person who can order the start of a dive, subject to appropriate work permits etc. Other relevant parties, such as a diving superintendent, offshore manager, ship's master, client representative or the installation manager, can, however, tell the supervisor to terminate a dive for safety or operational reasons.

There will be times, for example during operations from a DP vessel, when the supervisor will need to liaise closely with other personnel, such as the vessel master or the DP operator. In such circumstances, the supervisor must recognise that the vessel master has responsibility for the overall safety of the vessel and its occupants.

The supervisor is entitled to give direct orders in relation to health and safety to any person taking part in, or who has any influence over, the diving operation. These orders take precedence over any company hierarchy. These orders could include instructing unnecessary personnel to leave a control area, instructing personnel to operate equipment, etc.

To ensure that the diving operation is carried out safely, supervisors will need to ensure that they consider a number of points. For example:

- They should satisfy themselves that they are competent to carry out this work and that they understand their own areas and levels of responsibility and who is responsible for any other relevant areas. Such responsibilities should be contained in the relevant documentation. They should also ensure that they are in possession of a letter from the diving contractor appointing them as a diving supervisor;
- They will need to satisfy themselves that the personnel they are to supervise are competent to carry out the work required of them and have been familiarised with the work to be carried out and the emergency procedures. They should also check, as far as they are reasonably able, that these personnel are fit and in possession of a valid diving certificate and a valid medical certificate of fitness;

- They will need to check that the equipment used for any particular operation is adequate, safe, properly certified and maintained. They can do this by confirming that the equipment meets the requirements set down in this code and the diving contractor DMS. They should also ensure that the equipment is adequately checked by themselves or another competent person prior to its use. Such checks should be documented, for example, on a pre-prepared checklist, and recorded in the operations log for the project;
- They have read and understood all relevant project specific procedures, method statements and dive plans;
- They will need to ensure that all possible foreseeable hazards have been evaluated and are fully understood by all relevant parties and that, if required, training is given. In addition, prior to commencement of a project an on-site job safety analysis (JSA) needs to be carried out. If the situation has changed, further risk assessment and MoC will need to be undertaken. Also toolbox talks should be carried out at each shift change and prior to the commencement of a project critical job;
- They will need to ensure that the operation they are being asked to supervise complies with the requirements of this code and the diving contractor DMS. Detailed advice on how they can ensure this is given in various sections of this code;
- They will need to establish that all involved parties, including during SIMOPS, are aware that a diving operation is going to start or continue. They will also need to obtain any necessary permission before starting or continuing the operation, normally via a permit to work system;
- The supervisor will need to have clear audible and, if possible, visual communications with any personnel under their supervision. For example, a supervisor will be able to control the raising and lowering of a diving bell adequately if there is a dedicated and hard-wired audio link with the winch operator, even though the winch may be physically located where the supervisor cannot see it or have ready access to it (*Ref. IMCA D 023, IMCA D 024, IMCA D 037*);
- The supervisor also needs to have clear communication with other personnel on the diving location such as marine crew, DP operators, crane drivers and ROV personnel (*Ref. IMCA D 023, D 024, D 046, AODC 032 (being revised), M 205*);
- During saturation or bell diving operations, supervisors will need to be able to see the divers inside the bell or compression chamber. This will normally be achieved on the surface by means of direct viewing through the viewports or by means of cameras, but when the bell is under water this will need to be by means of a camera;
- The supervisor will need to have direct communications with any diver in the water at all times, even if another person needs to talk to, or listen to, the diver. In case another person is talking to the diver a number of fundamental rules should be followed to ensure the continued safety link between the diver and supervisor. These are:
  - the supervisor should not pass over the total communication responsibility to anyone, other than another properly appointed diving supervisor
  - at all times, the diving supervisor needs to be able to hear the diver's voice communication and breathing pattern, even if another person is joined into the communications link
  - in any communications system the diving supervisor needs to be able to disconnect all other personnel immediately so that the direct link between the diver and supervisor is uninterrupted;
- Ensuring that proper records of the diving operations are maintained.

3.6 Divers

Divers are responsible for undertaking duties as required by the diving supervisor. Divers should:

- inform the diving supervisor if there is any medical or other reason why they cannot dive;
- inform the diving supervisor when they use/have taken any medication;
- ensure that their personal diving equipment is working correctly and is suitable for the planned dive;
- ensure that they fully understand the dive plan and deem themselves competent to carry out the planned task;

- know the routine and emergency procedures;
- report any medical problems or symptoms that they experience during or after the dive;
- report any equipment faults, other potential hazards, near misses or accidents;
- check and put away personal diving equipment after use;
- keep their logbooks up to date and present it for signing by the diving supervisor after each dive.

3.7 Life Support Supervisor

Where the diving contractor has provided life support personnel for projects involving saturation or closed bell diving techniques life support supervisors should be appointed by the diving contractor in writing and be responsible for the operation of a chamber complex with associated equipment.

3.8 Other Diving and Support Personnel

It is the responsibility of the diving contractor that all categories of personnel used during diving operations (*Ref. IMCA C 003*) including, but not limited to ROV personnel, rigging crew, inspection controllers and surveyors have been issued with clearly defined and documented roles and responsibilities.

4 Equipment

4.1 DESIGN

IMCA has produced Diving Equipment Systems Inspection Guidance Notes (DESIGN), which describe minimum safety, equipment and maintenance requirements for various types of diving systems. They include DESIGN for:

- surface orientated (air) diving systems (*Ref. IMCA D 023*);
- saturation (bell) diving systems (*Ref. IMCA D 024*);
- surface supplied mixed gas diving systems (*Ref. IMCA D 037*);
- mobile/portable surface supplied systems (*Ref. IMCA D 040*);
- hyperbaric evacuation systems (*Ref. IMCA D 053*).

In addition guidance on the initial and periodic examination, testing and certification of diving plant and equipment, including when new, when first installed and when moved has been published (*Ref. IMCA D 018*).

These guidance notes are mentioned in the equipment sections below, in section 11, and are available from the IMCA website.

4.2 Equipment Location and Operational Integrity

4.2.1 Location

The choice of equipment location will be determined by the type of installation (a fixed structure may differ from a vessel or floating structure), the detail of the type of diving equipment involved, the integrity of any handling system with respect to lifting points or load bearing welds, and structures, etc. In this respect it should be ensured that in-date test certificates for all equipment are available where required.

In some applications the diving system may be required to operate in a hazardous area (e.g. an area in which there is the possibility of danger of fire or explosion from the ignition of gas, vapour or volatile liquid). All diving equipment used in such an area must comply with the safety regulations for that area.

Diving supervisors should also comply with any specific site requirements and where required obtain an appropriate permit to work before conducting diving operations.

Equipment location is often dependent on available deck space. However, if it is possible then placing the diving deployment system close to a ship's centre of gravity will minimise motion.

4.2.2 Deck Plan

A deck layout or plan should be prepared prior to mobilisation in order that a suitable equipment location and the service connections required are clear to all parties.

When preparing the deck plan the following should be taken in consideration:

- establishing the maximum deck load and the dynamic loading applied to the deck when launching or recovering the diving basket or bell. Based on deck calculations load distribution measures or additional deck reinforcements may need to be installed;
- the lay-out of the plant and equipment such that there is access available around the diving system and any other working areas, which is sufficient to allow operational personnel to safely and efficiently carry out their duties;
- provision of suitable lighting for operational personnel around the diving system, including emergency lighting, and any other working areas;
- plant and equipment should be easily accessible for maintenance;

- emergency escape and stretcher routes are available;
- access to suitable firefighting arrangements;
- noise exposures should be as low as practically possible.

4.2.3 Sea Fastening

All items of diving plant on a vessel and fixed and floating structure should be appropriately sea fastened. The sea fastening required should take into account, for example, the weights and dimensions of the equipment, dynamic loadings, exposure to wind and waves, ice loading and movements of the vessel and floating structure. There should be supporting documentation available from a competent person attesting that the necessary calculations have been completed.

If the sea fastening requires any welded fixtures then there should be NDT reports available confirming the welds were satisfactorily tested by a competent person. Before welding any part of the diving system to a vessel or fixed/floating structure, the position of fuel tanks and any other possible problem/hazards should be ascertained.

4.3 Equipment Suitability and Ergonomics

The diving contractor will need to be satisfied that the equipment provided for the diving project is suitable for the use to which it will be put, in all foreseeable circumstances on that project.

The design and layout of the plant and equipment should aim to reduce negative effects from environmental factors on the diving personnel safety, efficiency or comfort. This includes the chambers, control room, diving closed/wet bell and diving baskets and divers/deck personnel working conditions.

Equipment suitability and ergonomic layout can be assessed by the evaluation of a competent person, classification society, clear instructions or statements from the manufacturer or supplier and physical testing.

New, or innovative, equipment will need to be considered carefully, but should not be discounted because it has not been used before.

4.4 Certification

The standards and codes used to examine, test and certify plant and equipment, and the requirements of those who are competent to carry out such examinations, tests and certification, have been established (*Ref. IMCA D 018, IMCA D 004, IMO Code of Safety for Diving Systems 1995, Resolution A.831(19) and IMO Guidelines and Specifications for Hyperbaric Evacuation Systems Resolution A.692(17)*).

All equipment and plant supplied for use in a diving operation will need to comply with at least these standards and codes. Suitable certificates (or copies) should be provided at the worksite for checking (see also section 4.15).

In addition to the equipment and plant certification mentioned above, portable diving systems and fixed diving systems should also comply with applicable national regulations/standards IMO and flag state requirements.

Fixed diving systems are normally classified by a classification society.

A fixed diving system, as defined in the IMO code of practice, may also be certified and issued with a diving system safety certificate (*Ref. IMO Code of Safety for Diving Systems 1995 Resolution A.831(19)*).

4.5 Diving Equipment System Audits, Assessments and Analysis

4.5.1 Self Auditing

Diving contractors should have a process in place for self-auditing their diving systems and equipment, including hyperbaric evacuation systems, during mobilisation and on an annual basis, in accordance with IMCA guidelines (*Ref. IMCA D 011, IMCA D 023, IMCA D 024, IMCA D 037, IMCA D 040, IMCA D 052, IMCA D 053*).

DP systems, vessels and ROVs need also to be audited in accordance with IMCA guidelines.

4.5.2 HAZOP/FMEA

Furthermore, a systematic assessment of the diving system and its sub-systems should be carried out by relevant discipline competent persons. This should take the form of a formal risk assessment, which may consist of a detailed risk assessment, HAZOP or an FMEA, to provide a systematic assessment for the identification of potential failure modes and to determine their effects and to identify actions to mitigate the failures. The assessment should ensure that a failure of a single component should not lead to a dangerous situation (*Ref. IMCA D 039, IMCA D 011, IMO Code of Safety for Diving Systems 1995, Resolution A.831(19)*).

4.5.3 FMECA

FMECA is an extension of the FMEA process. In addition to the basic FMEA, an FMECA includes a criticality analysis, which is used to chart the probability of failure mode against the severity of its consequences. The result should highlight failure modes with relatively high probability and severity consequences, allowing remedial effort to be directed to where it will produce the greatest value (*Ref. IMCA D 011*).

4.5.4 Programmable Logic Controllers (PLCs)/FMEA

When PLCs are used in diving equipment, the operation and failure modes should be understood. To achieve an understanding, an FMEA should be carried out and the components and complete systems should be appropriately tested (*Ref. IMCA M 15/12, information note IMCA SEL 9/12*).

4.6 Power and Emergency Power Supply

The power source for the diving system may be independent of the surface platform or vessel's power supply. If this is by a separate generator, the positioning of this should be governed by the following factors: vibration, noise, exhaust, weather, length of cable required, possible shutdown phases, fire protection and ventilation.

In addition to the main power source there needs to be an alternative power supply for safe termination of the diving operation and to ensure that life support for divers under pressure can be maintained (*Ref. IMCA D 023, IMCA D 024, IMCA D 037, IMCA D 040, IMCA D 053, IMCA M 189, IMO Code of Safety for Diving Systems 1995, Resolution A.831(19)*).

4.7 Gases

Gases stored in cylinders at high pressure are potentially hazardous.

The dive project plan needs to specify that the gas storage areas need to be adequately protected by, for example:

- ♦ the provision of suitable fire extinguishing systems;
- ♦ physical guards against dropped objects (*Ref. IMCA D 009*).

All gases used offshore will need to be handled with appropriate care.

4.7.1 Storage Cylinders

Gas cylinders will need to be suitable in design, fit for purpose and safe for use.

Each cylinder should be tested and have appropriate certification issued by a competent person (*Ref. IMCA D 018*).

Cylinders used for diving within the scope of this code may be subjected to special conditions, such as use in salt water, and will therefore need special care (see also section 4.15.4).

Gas storage in confined spaces requires continuous atmosphere monitoring systems.

Any relief valves or bursting discs should be piped to dump overboard and not in to the enclosed space (*Ref. IMCA D 024*).

4.7.2 Gas Supply Hose Restraints

All gas supply hoses (HP and LP) should be correctly secured at the connection point with whip devices attached to a secure fixed point. The type of whip checks will differ depending on the pressure of gas. A tie back needs to be considered for its length, material and security *(Ref. IMCA D 023, IMCA D 024, information note IMCA D 03/11).*

4.7.3 Marking and Colour Coding of Gas Storage

Fatal accidents have occurred because of wrong gases or gas mixtures being used in a diving project.

The diving contractor will need to ensure that all gas storage units comply with a recognised and agreed standard of colour coding and marking of gas storage cylinders, quads and banks.

Where appropriate, pipework will also need to be colour coded.

All gases should be analysed before use in any case (*Ref. IMCA D 043, IMO Code of Safety for Diving Systems 1995, Resolution A.831(19)*).

4.7.4 Divers' Breathing and Reserve Gas Supply

4.7.4.1 Breathing Gas Supply

The correct use of breathing gases for divers and the continuity of their supply are vital to divers' safety and health. Total or partial loss or interruption of a diver's breathing gas supply can be fatal.

Equipment will be needed to supply every diver, including the standby diver, with breathing gas of the correct composition, suitable volume, temperature and flow for all foreseeable situations, including emergencies. In particular, the supply will need to be arranged so that no other diver (including the standby) is deprived of breathing gas if another diver's umbilical is cut or ruptured (*Ref. information note IMCA D 04/11, IMCA D 023, IMCA D 024, IMCA D 037, IMCA D 040, IMCA D 053*).

4.7.4.2 Reserve Gas Supply

Each working diver in the water will need to carry a reserve supply of breathing gas that can be quickly switched into the breathing circuit in an emergency.

The reserve gas supply should have sufficient capacity to allow the diver to reach a place of safety (*Ref. IMCA D 023, IMCA D 024, IMCA D 037, IMCA D 040*).

4.7.4.3 Analysers

An in-line oxygen analyser with an audible/visual hi-lo alarm will need to be fitted to the diver's gas supply line in the dive control area. The sampling should be from downstream of the final supply valve to the diver. This should prevent the diver being supplied with the wrong percentage of oxygen even if the breathing medium is compressed air.

In addition, a carbon dioxide analyser will need to be fitted in all saturation operations using gas reclaim equipment.

Sufficient analysers for continuous monitoring of the reclaim, bell, DDC and divers supply, without having to cross connect between two analysers, need to be installed.

Consideration should also be given to the provision of additional monitoring; e.g. H_2S, VOCs and CO (*Ref. IMCA D 023, IMCA D 024, IMCA D 037, IMCA D 040, IMCA D 048*).

4.7.5 Emergency Breathing Gas Cylinders for Diving Basket/Wet Bell

When a diving basket or wet bell is used by surface-supplied divers, emergency breathing gas cylinders will need to be supplied in the basket or fitted to the wet bell in a standard, agreed layout.

This enables the divers to access the cylinders rapidly in an emergency (*Ref. IMCA D 023, IMCA D 037, IMCA D 048*).

4.7.6 Oxygen

Pressurised oxygen can fuel a serious fire or cause an explosion, but can be used safely if stored and handled correctly.

Any gas mixture containing more than 25% oxygen by volume will need to be handled like pure oxygen.

It should not be stored in a confined space or below decks but out in the open, although protected as detailed in section 4.7.

Any materials used in plant which is intended to carry oxygen will need to be compatible with oxygen at working pressure and flow rate and cleaned of hydrocarbons and debris to avoid explosions (*Ref. IMCA D 012, IMCA D 048*).

Formal cleaning procedures for such equipment will need to be provided by the diving contractor, together with documentary evidence that such procedures have been followed (*Ref. IMCA D 031*).

4.8 Communications with Divers

Each diver in the water will need a communication system that enables direct, two way, voice contact with the supervisor on the surface. Speech processing equipment will be needed for divers who are breathing gas mixtures containing helium, which distorts speech. All such communications will need to be recorded, and the recording kept for a minimum of 24 hours before being erased (*Ref. IMCA D 023, IMCA D 024, IMCA D 037, IMCA D 053*).

If an incident occurs during the dive, or becomes apparent after the dive the communication record will need to be retained until the investigation has been completed.

4.9 Closed Diving Bells

4.9.1 Breathing Mixture Supply Uncontrolled Pressure Loss Prevention

The diving bell will need to be fitted with suitable protective devices that will prevent uncontrolled loss of the atmosphere inside the diving bell if any or all of the components in the main umbilical are ruptured (*Ref. AODC 009, IMCA D 024*).

4.9.2 Diving Bell Emergency Recovery Equipment

The dive project plan needs to include the equipment, personnel and procedures needed to enable the divers to be rescued if the bell is accidentally severed from its lifting wires and supply umbilical. The bell should be:

- equipped with a relocation device using the internationally recognised frequency to enable rapid location if the bell is lost;
- fitted with the internationally agreed common manifold block for attachment of an emergency umbilical;

- capable of sustaining the lives of trapped divers for at least 24 hours;
- fitted with through water communications.

(Ref. AODC 019, IMCA D 024).

Each diving bell needs an alternative method of recovery to the surface if the main lifting gear fails. This is normally by means of the guide wires and their lifting equipment (Ref. IMCA D 024, AODC 019).

If release weights are employed, the weights will need to be designed so that the divers inside the bell can shed them. This design will need to ensure that the weights cannot be released accidentally (Ref. AODC 061, IMCA D 024). The bell will need to be fitted with a stand-off arrangement such that the divers can freely exit and re-enter the bell.

4.9.3 Assistance to a Stricken or Fouled Closed Diving Bell

4.9.3.1 Methods of Recovery

During closed diving bell operations an appropriate method of recovery of the divers needs to be provided in the case of a stricken or fouled closed diving bell. This might be done by a surface standby diver or another robust alternative method (*Ref. IMCA D 024*).

The methods of recovery need to be risk assessed to establish the most suitable method, equipment and resources required.

4.9.3.2 Surface Standby Diver Deployment Plan

When a surface standby diver is planned to be used, the diver will need to be available with equipment suitable to assist in an emergency within the applicable working depth range (see also section 5.2.3.3). It is not necessary that a full surface diving system be provided but the equipment which is provided should meet the relevant sections on minimum requirements for surface diving equipment as laid out in IMCA D 023 (*Ref. IMCA D 024*).

4.9.3.3 Alternative Assistance Plan

The alternative assistance plan should be robust (proven through exercises) and developed to ensure assistance can be rapidly given to a stricken or fouled bell at all depths, including the period while the bell is close to or in a moonpool (*Ref. IMCA D 024*).

4.9.4 Equipment Level

Closed diving bells used for saturation or bounce diving will need a minimum level of equipment and facilities (*Ref. IMCA D 024*).

- Divers will need to be able to enter and leave the bell without difficulty;
- Lifting equipment will need to be fitted to enable a person in the bell to lift an unconscious or injured diver into the bell in an emergency;
- Divers will also need to be able to transfer under pressure from the bell to a surface compression chamber and vice versa.

The bell will need doors that open from either side and that act as pressure seals.

Valves, gauges and other fittings (made of suitable materials) will be needed to indicate and control the pressure within the bell. The external pressure will also need to be indicated to both the divers in the bell and the diving supervisor.

Adequate equipment, including reserve facilities, will be needed to supply an appropriate breathing mixture to divers in, and working from, the bell.

Equipment will be needed to light and heat the bell.

Adequate first-aid equipment will be needed (*Ref. DMAC 15*).

Lifting gear will be needed to lower the bell to the depth of the diving project, maintain it at that depth, and raise it to the surface, without the occurrence of excessive lateral, vertical or rotational movement (*Ref. IMCA D 024*).

4.10 Hyperbaric Evacuation Systems

4.10.1 Hyperbaric Rescue Unit (HRU)

The HRU used for evacuation and rescue of saturation divers requires a minimum level of equipment and facilities. This includes a launch system and life support. The requirements can be found in IMO Resolution A.692(17) and IMCA guidelines (*Ref. IMCA D 053, IMCA D 052, IMCA D 004, IMCA D 027, IMCA D 018*). See also section 8 for further details.

Thermal balance trials should be conducted to IMCA guidelines (*Ref. information note IMCA D 02/06*).

The HRU should be fitted with a suitable flange for mating with a defined reception chamber, such as an HRF (*Ref. IMCA D 051*).

In an emergency, it is possible that personnel with no specialised diving knowledge will be the first to reach an HRU. To ensure that rescuers provide suitable assistance and do not accidentally compromise the safety of the occupants, an IMO standard set of markings and instructions has been agreed (*Ref. IMCA D 027*). Such markings will need to be clearly visible when the system is afloat.

4.10.2 Life Support Package (LSP)

An emergency life support package that can be connected to the HRU to provide external services to support the HRU should meet the requirements as laid out in IMCA D 053 and IMO Resolution A.692(17). See also section 8 for further details.

4.10.3 Hyperbaric Reception Facility (HRF)

A hyperbaric reception facility consisting of suitable chamber(s) into which the divers can be transferred from the HRU, with facilities for decompression and treatment of the divers, should meet the requirements as laid out in IMCA D 053. It should be fitted with a suitable flange for mating with an HRU (*Ref. IMCA D 051*). See also section 8 for further details.

4.11 Electricity and Battery Operated Equipment

Divers, and others in the dive team, are required to work with equipment carrying electric currents, which presents the risk of electric shock and burning. Procedures have been developed for the safe use of electricity under water, and any equipment used in a diving operation will need to comply with this guidance (*Ref. IMCA D 045*).

Battery operated equipment may be a potential hazard when taken into a hyperbaric environment. The safety and suitability should be assessed by a competent person (*Ref. IMCA D 041*).

Recharging lead-acid batteries generates hydrogen that can provide an explosion hazard in confined spaces (*Ref. AODC 054, IMCA D 002*). Care will need to be taken to provide adequate ventilation.

4.12 Man-riding Handling Systems

Particular safety standards will need to be applied when using lifting equipment to carry personnel because serious injury may result from falling. Such handling systems should be designed to be man-riding (*Ref. IMCA D 018, IMCA D 023, IMCA D 024, IMCA D 037, IMCA D 053*).

4.12.1 Winches

Both hydraulic and pneumatic winches will need to be provided with independent primary and secondary braking systems. They are not to be fitted with a pawl and ratchet gear in which the pawl has to be disengaged before lowering (*Ref. IMCA D 018, IMCA D 023, IMCA D 024*).

4.12.2 Diving Baskets and Wet Bells

A working diving basket or wet bell, used in support of surface-supplied diving, will need to be able to carry at least two divers in an uncramped position.

A standby diving basket, where provided, should be capable of at least deploying and recovering a single diver.

It will need to be designed with a chain or gate at the entry and exit point to prevent the divers falling out, and with suitable hand holds for the divers. The design will also need to prevent spinning or tipping (*Ref. IMCA D 018, IMCA D 023, IMCA D 037*).

4.12.3 Lift Wires

Particular standards and testing criteria will need to be used for man-riding lift wires, including wires intended for secondary or back-up lifting. These wires will need to have an effective safety factor of 8:1, be non-rotating (see IMCA D 024 for exception) and be as compact as possible to minimise the space requirements of their operating winches. (*Ref. IMCA D 018, IMCA D 023, IMCA D 024, IMCA D 037, IMCA SEL 022/IMCA M 194*).

4.13 Medical/Equipment Locks and Diving Bell Trunks

The inadvertent release of any clamping mechanism holding together two pressurised units under internal pressure may cause fatal injury to personnel both inside and outside the units. All such clamps will need pressure indicators and interlocks to ensure that they cannot be released while under pressure (*Ref. IMCA D 023, IMCA D 024, IMCA D 037, IMCA D 053*). On saturation systems the pressure indicator and pressure/exhaust lines should have their own penetrators to avoid single point failure in case of blockage.

4.14 Therapeutic Recompression/Compression Chamber

No surface supplied diving operation within the scope of this code is to be carried out unless a two-compartment chamber is at the worksite to provide suitable therapeutic recompression treatment.

4.15 Maintenance of Diving Equipment

Diving plant and equipment is used under offshore conditions, including frequent immersion in salt water. It therefore requires regular inspection, maintenance and testing to ensure it is fit for use, e.g. that it is not damaged or suffering from deterioration.

4.15.1 Periodic Examination, Testing and Certification

Detailed guidance exists on the frequency and extent of inspection and testing required of all items of equipment used in a diving project, together with the levels of competence required of those carrying out the work (*Ref. IMCA D 018, IMCA D 004*).

4.15.2 Planned Maintenance System

The diving contractor will need to have an effective management system for planned maintenance and spares control for all plant and equipment (*Ref. IMCA D 018, IMCA D 004*).

Preparation and optimisation of maintenance programmes should include risk analysis, criticality of the equipment and contractor's experience of component wear and tear.

The maintenance programme should:

- describe the necessary maintenance and planned testing of components and plant and the required competent person;
- seek to avoid unforeseen equipment malfunction through routine checking and replacement of components.

Each equipment item will need to have its own identification number and a record needs to be kept which should describe the maintenance carried out, date and the competent person who carried out the maintenance.

4.15.3 Equipment and Certificate Register

An equipment register will need to be maintained at the worksite, with copies of all relevant certificates of examination and test.

It should contain:

- information, such as design specifications and calculations of the equipment items such as, but not limited to, diver launch and recovery systems and winches, electrical systems, pressure vessels, plumbing, pipework and umbilicals;
- details of any applicable design limitations, for example, maximum weather conditions for use, if applicable.

4.15.4 Cylinders Used Under Water

4.15.4.1 General

Divers' emergency gas supply cylinders (bail-out bottles) and cylinders used under water for back-up supplies on diving bells and baskets can suffer from accelerated corrosion due to ingress of water. Particular care will need to be taken to ensure that they are regularly examined and maintained (*Ref. AODC 010, IMCA D 018, information note IMCA D 13/06*).

4.15.4.2 Gas Cylinder Internal Inspection

IMCA D 018 provides guidance on both when new and when in service on gas cylinders taken underwater.

Evidence shows that due to ingress of water very serious corrosion, even to the point of failure, can occur in much less than two years.

The six monthly bail-out bottle inspections should include that:

- after removal of the pillar valve in the neck of the bottle, a check by a competent person for any evidence of water, moisture, or rust or corrosion particles in the bottle;
- any evidence of water dripping from the inside, evidence of rust or corrosion particles should lead to a full inspection as appropriate before it is used again.

Note: Pillar valves need to be removed and replaced by competent personnel using the correct tools, as damage can easily be caused if incorrect techniques are used.

Gas cylinders carried on the outside of a diving bell are at similar risk, however the possibility of water entering is less than with a bail-out bottle and, therefore, it is recommended that a simple check is only carried out if they are found to have lost pressure to a level which could have allowed water to enter them.

4.15.4.3 Manifold Design for Charging Underwater Cylinders

The design of the manifold used for charging cylinders on the closed diving bell and in the wet bell or diving basket should be such that during charging it prevents water entering the cylinders, in order to avoid internal corrosion in the cylinders.

Water may get trapped in the atmospheric part between the isolation valve and plug, which is normally fitted to prevent water or dirt entering into the manifold.

The design of the manifold should allow for venting this part between the isolation valve and the plug.

The manifold should be pointing downwards to self-drain on removal of the plug.

Prior to recharging bottles, any water which may be trapped in the manifold should first be ejected or drained.

4.15.5 Closed Diving Bell, Wet Bell, Diving Basket and Clump Weight Lift Wires

Frequent immersion in salt water, shock loading from waves, passing over multiple sheaves, etc., can cause wear and deterioration to the lift wires of closed diving bells, wet bells and diving baskets as well as clump weight wires if they are not properly maintained. Specialised advice on maintenance exists and will need to be followed to ensure that wires remain fit for purpose (*Ref. IMCA D 018, IMCA D 023, IMCA D 024, IMCA D 037, IMCA SEL 022/IMCA M 194*).

4.15.6 Lift Bags

Special requirements for the periodic examination, test and certification of lift bags have been established. Manufacturers' maintenance instructions and testing requirements will need to be followed (*Ref. IMCA D 016, IMCA D 018*).

4.15.7 Underwater Tools

Tools used during diving operations (hydraulic/pneumatic) are to be maintained as per manufacturer's guidance and records of such available.

4.16 Lifting Equipment Design, Periodic Test and Examination Requirements

All lifting equipment should be examined by a 'competent person' before the equipment is used for the first time, after installation at another site and after any major alteration or repair (Ref. IMCA D 018). Regular examination is also recommended. Any additional testing specified should be at the discretion of the competent person.

Any lifting wire should be provided with a test certificate confirming its safe working load (SWL) (see also note below). The SWL should never be exceeded during operations and should include the deployment device, the number of divers to be deployed (with all their equipment) and any components that hang from the lifting wire (including wire weight in air). The condition and integrity of the wire should be checked in accordance with the planned maintenance system (*Ref. IMCA D 018*, or more frequently as circumstances dictate).

The lifting and lowering winch should be rated by the manufacturer for a safe working load at least equal to the weight of the deployment device plus divers in air plus any additional components. An overload test of the winch's lifting and braking capacity should be undertaken after:

- all permanent deck fixings are in place;
- NDT on relevant welds has been completed.

All loose lifting gear, such as sheaves, rings, shackles and pins should have test certificates when supplied and be examined at six-monthly intervals thereafter in accordance with the planned maintenance system (PMS) (*Ref. IMCA D 018*). The original manufacturers' test certificates should show the SWL and the results of proof load tests undertaken on the components.

(Note: For lifting equipment the terms SWL and also working load limit (WLL) are used. The differences are as follows: WLL is the ultimate permissible load assigned by the manufacturer of the item. The SWL may be the same as the WLL but may be of a lower value assigned by an independent competent person taking account of particular service conditions (*Ref. IMCA SEL 022/ IMCA M 194*).)

4.17 Chain Lever Hoists

Chain lever hoists are used extensively offshore during diving operations. However, there is a history of failure. Many of these units are not designed for subsea use and therefore are prone to corrosion and will require extensive maintenance and control of the time left submerged (*Ref. IMCA D 028*).

4.18 Vessel, Fixed Platform and Floating Structure Cranes

Any vessel, fixed platform and floating structure used for diving support should be inspected to ensure that the crane(s) used for underwater operations are fit for purpose (*Ref. IMCA D 035*).

Crane wires used underwater normally suffer damage from internal corrosion due to ingress of seawater and dynamic loadings in particular when loads are lowered/lifted through the splash zone. IMCA guidance is available on the maintenance and inspection of crane wires (*Ref. IMCA SEL 022/IMCA M 194*).

5 Personnel

5.1 Qualifications and Competence

To work safely, efficiently and as a member of a team, personnel need to have a basic level of competence of the task they are being asked to carry out.

Competence is not the same as qualification. A person who has a particular qualification, such as a diver training certificate, should have a certain level of competence in that area but the diving contractor and the diving supervisor will need to satisfy themselves that the person has the detailed competence necessary to do the specific task required during the particular diving operation.

The different members of the diving team will require different levels and types of competence (*Ref. IMCA D 013, information note IMCA D 11/13, IMCA C 003, information note IMCA M 15/12, information note IMCA SEL 9/12*).

5.1.1 Tenders

Tenders are there to assist the divers. They should therefore be competent to provide the level of assistance that the diver expects and needs.

Competence is required of tenders in that they should:

- understand the diving techniques being used. This includes a detailed knowledge of the emergency and contingency plans to be used, including line communications and emergency communications;
- be fully familiar with all of the diver's personal equipment;
- understand the method of deployment being used and all of the actions expected of them in an emergency;
- understand the ways in which their actions can affect the diver.

Some tenders will be fully qualified, but less experienced divers. In such cases their competence will be able to be verified easily. In cases where the tender is not a diver, however, and may in fact be a member of the deck crew, then their competence will need to be established on the basis of previous experience supplemented, where appropriate, with any additional training which the diving contractor or supervisor feel is necessary (*Ref. IMCA C 003*).

5.1.2 Divers

5.1.2.1 Qualifications

Divers should have completed diver training to an IMCA-recognised closed bell or surface supplied diver qualification and be in possession of a valid training/ competence certificate (*Ref. IMCA C 003*). These are the only two grades of diver allowed to work within the scope of this code.

All divers at work:

- should hold a diving qualification suitable for the work they intend to do;
- will need to have the original certificate in their possession at the site of the diving project – copies should not be accepted *(Ref. IMCA C 003).*

IMCA produces an up-to-date list of diving and supervisor certificates that are IMCA-recognised (*Ref. information note IMCA D 11/13*).

5.1.2.2 Competence

Competence is required of a diver in several different areas simultaneously:

- The diver will need to be competent to use the diving techniques being employed. This includes the type of breathing gas, personal equipment and deployment equipment;
- They will need to be competent to work in the environmental conditions. This will include wave action, visibility and current effects;
- They will need to be competent to use any tools or equipment they need during the course of the dive;
- They will need to be competent to carry out the tasks required of them. This will normally require them to understand why they are doing certain things and how their actions may affect others.

Prior to commencement of the diving operations the competence of the divers should be assessed (*Ref. IMCA C 003*) and depending on the tasks required to be carried out additional training may have to be provided.

5.1.2.3 Task Specific Competence and Training

Even tasks which are apparently very simple, such as moving sandbags under water, require a degree of competence, both to ensure that the pile of sandbags created is correct from an engineering viewpoint and also to ensure that the diver lifts and handles the bags in such a way that they do not injure themselves.

Previous experience of a similar task is one demonstration of competence but care should be taken to ensure that a diver is not claiming or exaggerating experience in order to obtain work or appear knowledgeable to their superiors. If there is any doubt about the validity of experience then the individual should be questioned in detail to establish their exact level of knowledge.

Where a diver has not carried out a task before, or where a task may be new to every member of the diving team, competence can be gained by detailed review of drawings and specifications, the equipment to be operated under water, the area to be worked in and any other relevant factors.

The time required for this review, the depth of detail reviewed and the checks necessary to confirm competence, will depend on the complexity of the task involved and the hazards associated with the operation.

For instance, an experienced inspection diver asked to use a new measuring tool may well be competent to carry out this operation after a few minutes' handling the tool on deck and reading an instruction manual. However, a team of divers which is required to install a complex new type of unit on the seabed may need not only instruction, but also actual trials under water in using the unit. The diving contractor will need to establish the level of competence required for a particular application (*Ref. IMCA C 003*).

5.1.2.4 Divers Operating Deck Decompression Chambers

In surface supplied diving operations, the personnel operating the DDC should be trained in its use by a competent operator and assessed and deemed competent before being allowed to run the chamber on their own (*Ref. IMCA C 003*). Some companies may wish to issue letters of appointment for such chamber operators.

5.1.2.5 Surface Supplied Diving using Mixed Gas or Nitrox

Prior to commencement of surface supplied diving using mixed gas or nitrox divers will need to have their competence assessed. Acceptance of the divers' competence can be based on demonstrating previous documented experience or after successful completion of company and dive system familiarisation training (*Ref. IMCA C 003, IMCA D 048, IMCA D 030*).

5.1.3 Formally Trained Inexperienced Divers

Formally trained inexperienced divers need to gain competence in a work situation and it is correct to allow this provided it is recognised by the other members of the team that the individual is in the process of gaining experience and competence. In such cases it would be expected that the other team members and particularly the supervisor would pay particular attention to supporting the person gaining competence (*Ref. IMCA C 003*).

Diving contractors should, when there is appropriate work and bed space available, allow formally trained inexperienced diver(s) to gain offshore experience.

5.1.4 Deck Crew/Riggers and Crane Operators

Divers rely heavily on the support given to them from the surface by the deck crew/riggers and crane operators. The actions of the people on deck can have a major impact on the safety and efficiency of the work being carried out under water.

The deck crew/riggers supporting the diving operations will need to have competence in a number of areas and will need to:

- understand and be familiar with good rigging practice and seamanship. This will include relevant knots, slinging, correct use of shackles, etc.;
- be familiar with safe working loads/working load limits and safety factors;
- understand the task that the diver is being asked to carry out under water;
- understand the limitations of a diver in relation to the work they can carry out. For example they will need to understand that a diver cannot normally lift an item under water which it took two men to carry on deck;
- understand the various ways in which equipment can be prepared on deck to ease the task of the diver under water.

(*Ref. IMCA C 002* – rigger and rigger foreman competence).

Crane operators should be competent and trained to work with divers and diving operations (*Ref. IMCA C 002* – crane operator competence).

There should be a toolbox talk prior to each job. During the toolbox talk the diving supervisor, or someone acting on behalf of the supervisor, should give an explanation to the deck crew/riggers supporting the diving operations and if applicable to the crane operator about the work to be done and the safety precautions to be taken.

With a larger deck crew it will not be necessary for all members of the crew, some of which may be divers, to have the same level of competence, provided they are closely overseen by a competent and experienced person, such as the rigger foreman.

5.1.5 Life Support Personnel

On projects involving saturation or closed bell diving techniques, specialised personnel should be used to look after stored high pressure gases and to carry out the operations on and around the deck compression chambers in which the divers are living. Such personnel are life support supervisors (LSS), life support technicians (LST) and assistant life support technicians (ALST).

A certification scheme for life support technicians has been running for some years, administered by IMCA (*Ref. IMCA D 013*). All life support technicians need to hold a qualification as a life support technician and should be competent to carry out the tasks required (*Ref. IMCA C 003*).

5.1.6 Supervisors

There is only one person who can appoint a supervisor for a diving operation and that is the diving contractor. All supervisors should be appointed in writing.

The diving contractor should ensure all supervisory personnel have undergone documented leadership, management and supervisory skills training (*Ref. IMCA C 011*).

Under the IMCA Offshore Diving Supervisor and Life Support Technician Certification Scheme there are three types of supervisor (*Ref. IMCA D 013*).

5.1.6.1 Air Diving Supervisor

An air diving supervisor will need to have passed the relevant modules of the certification scheme (*Ref. IMCA D 013, IMCA D 11/13*) and be qualified and competent to supervise all surface diving operations including decompression in a deck chamber (*Ref. IMCA C 003*). Care will need to be taken that such an individual has the necessary competence if they are asked to supervise surface supplied mixed gas or nitrox diving operations, since the examination and training for air diving supervisor does not include surface supplied mixed gas or nitrox diving techniques (*Ref. IMCA D 030, IMCA D 048*).

5.1.6.2 Bell Diving Supervisor

A bell diving supervisor will need to have passed both air diving and bell diving modules of the certification scheme (*Ref. IMCA D 013, IMCA D 11/13*) and be qualified and competent to supervise all diving operations, including those in deck chambers (*Ref. IMCA C 003*).

5.1.6.3 Life Support Supervisor

A life support supervisor will need to have passed the life support technician module of the certification scheme (*Ref. IMCA D 013*) and, once having completed the requirements in IMCA C 003 and being considered competent by the diving contractor, will be qualified to supervise divers living in, or being compressed or decompressed in a deck chamber.

5.1.6.4 First Aid Training and Task Specific Competence

Supervisors do not normally need to be qualified in first aid; however the diving contractor should consider the role and requirements of the supervisor during a medical emergency.

If a diving operation is being planned, which does not fall clearly in to the areas normally undertaken by that diving contractor, then detailed consideration will need to be given to the most suitable qualification for the supervisors to be selected.

Clearly the issue of competence is more subjective and the diving contractor needs to consider the operations being planned and the competence of any individual being considered for appointment as a supervisor – the possession of the necessary qualification does not in itself demonstrate competence for any specific operation. The diving contractor will need to consider the:

- details of the planned operation, such as the complexity of the part of the operation the person is going to supervise;
- equipment and facilities which will be available to the supervisor;
- risks which the supervisor and divers may be exposed to;
- support which would be available to the supervisor in an emergency.

After such consideration, a decision will need to be made whether one supervisor can be responsible for all that is intended or whether more supervision is required.

Relevant previous experience supervising similar operations should demonstrate a suitable level of competence. For this purpose the logbook maintained by the supervisor can be consulted.

If relevant previous supervisory experience of similar operations cannot be demonstrated, due to unique features of the planned operation, or to the limited previous experience of the individual being considered, then the diving contractor should assess the relevant information available, consider the possible risks involved and make a decision as to the competence of the individual concerned.

It is possible, particularly on very large operations, a diving contractor may wish to appoint supervisors who are competent for parts of the operation.

5.1.7 Dive Technicians

Contractors should ensure that their dive technicians are correctly trained and have the required level of competence for the equipment being used and in the operations being conducted.

The contractor needs to define the training and competence requirements for the dive technicians.

It should be recognised that recent innovations in dive systems' design and their components may require expertise in areas that would not have been necessary in the past (e.g. increasing use of programmable logic controllers (PLCs)).

New entrants to the industry should be treated as trainees until deemed competent to work unsupervised.

The diving contractor should set out in the dive technician's letter of appointment the type of equipment and operation, e.g. surface supplied air, nitrox, mixed gas or saturation, together with any specific limitations, on which the individual may work.

A dive technician may be promoted to a senior dive technician following assessment of his/her work as a dive technician.

Depending on the complexity of the dive system the diving contractor will have to decide the number of dive technicians and senior dive technicians which are required. There may also be a requirement for a dive technician(s) specialised in PLCs.

IMCA guidance on dive technician and senior dive technician training and competence requirements is available *(Ref. IMCA D 001, IMCA C 003, information note IMCA SEL 9/12, information note IMCA M 15/12)*.

5.2 Numbers of Personnel/Team Size

5.2.1 General

Personnel engaged in diving operations should have a job description detailing their roles and responsibilities.

The diving contractor will need to specify the size of team based on the details of the project and the risk assessment. For a safe operation, this may need to include additional deck support personnel and other management or technical support personnel, such as project engineers or maintenance technicians.

The diving contractor will need to provide a sufficient number of competent and qualified personnel to operate and maintain all the equipment and to provide support functions to the diving team, rather than relying on personnel provided by others for assistance (e.g. clients, ship crews, etc.).

If personnel who are not employed by the diving contractor are to be used in the diving team for any reason, such as technicians, they will need to be carefully considered for competence and suitability before being included (*Ref. IMCA C 003*). Such personnel can create a hazard to themselves and others if they lack familiarity with the contractor's procedures, rules and equipment.

There will be exceptions to this requirement, for example, when a diving system is installed long term on a DSV and there are suitable technicians employed by the vessel owner. In such circumstances, these personnel, whose principal duties may be associated with the diving or ship's equipment, may form part of the diving team. Such an arrangement will need to be confirmed in writing, together with the responsibilities of these individuals.

To allow a diving operation to be conducted safely and effectively a number of eventualities should be considered when deciding team size and make up including the following:

- type of task;
- type of equipment (air, nitrox, heliox, saturation, etc.);
- deployment method;
- location;
- water depth;
- operational period (e.g. 12 or 24 hours per day);
- handling of any foreseeable emergency situations;
- size and complexity of the diving system and ancillary equipment.

The overriding factor should always be the safety of personnel during operation and maintenance. It is the absolute responsibility of the diving contractor to provide a well-balanced, competent team of sufficient numbers to ensure safety at all times.

When a surface supplied dive is taking place, a diving supervisor will need to be in control of the operation at all times. For larger projects, more than one supervisor may be needed on duty and a diving superintendent to be in charge of the overall diving operation (see also section 3.4).

For saturation diving operations a bell diving supervisor is responsible for the bell diving operations and a separate life support supervisor is responsible for the chamber operations. In addition a diving superintendent should be in charge of the overall operation.

Depending on the number of supervisors on duty consideration needs to be given to the availability of a relief supervisor.

Each supervisor will only be able to provide adequate supervision of a defined area of operations, including dealing with foreseeable contingencies or emergencies.

5.2.2 Tenders

For umbilicals that are tended from the surface, at least one tender is required for each diver in the water.

5.2.3 Standby Diver

5.2.3.1 Surface Supplied Diving

A standby diver will need to be in immediate readiness to provide any necessary assistance to the diver, whenever a diver is in the water. The standby diver will need to be in the immediate vicinity of the dive site, dressed and equipped to enter the water, but need not wear a mask or helmet. There will need to be one standby diver for every two divers in the water. The standby diver who normally remains on the surface needs to have a dedicated tender.

5.2.3.2 Surface Supplied Mixed Gas (Heliox) Diving

When using a wet bell, the bell man is the standby diver and will remain inside the bell except if he needs to leave the wet bell in an emergency.

Another standby diver, who does not require his own standby, will need to be on the surface with equipment suitable for intervention within the surface diving range (down to 50 metres), unless a robust alternative plan (proven through exercises) has been developed to ensure assistance can be rapidly given to a stricken or fouled wet bell at all depths within the range of the surface diver.

This surface standby diver need not be dressed for diving provided the equipment is available and may undertake other duties within the dive team while the wet bell is under water.

In such circumstances the standby diver can be deployed in a standby diving basket.

5.2.3.3 Closed Bell Diving

When using a closed bell, the bell man is the standby diver and will remain inside the bell except if he needs to leave the bell in an emergency.

Another standby diver, who does not require his own standby will need to be on the surface with equipment suitable for intervention within the surface diving range (down to 50 metres), unless a robust alternative plan (proven through exercises) has been developed to ensure assistance can be rapidly given to a stricken or fouled bell at all depths within the range of a surface diver, including the period while the bell is close to or in a moonpool (*Ref. IMCA D 024*) (see also section 4.9.3). This surface standby diver need not be dressed for diving provided the equipment is available, and may undertake other duties within the dive team while the bell is under water.

5.2.4 Life Support Personnel

The controls of a deck decompression chamber (DDC) used for surface supplied diving can be operated by any trained and competent person under supervision of the diving supervisor. All divers and qualified life support technicians (LSTs) are trained to operate a DDC.

Competent and qualified personnel providing life support will be needed to look after divers living in saturation. When divers are in saturation, normally two life support personnel of which one would be life support supervisor will need to be on duty at all times, although one may be absent for short periods such as toilet and refreshment breaks. In the absence of the LSS the bell diving supervisor is qualified to supervise the LST.

For large or complex systems where some operations may need to take place outside sat control, then it may be worthwhile having additional life support personnel such as an assistant life support technician (ALST).

5.2.5 Team Sizes

5.2.5.1 General

It should be understood that the great variance in the types of tasks for which divers are employed, together with advances in technology, make it hard for this document to offer anything more than general advice. Furthermore, it is not the aim of this document to remove the responsibility for safe operations from the contractor. Actual team sizes will need to be decided after completion of a risk assessment.

Individuals in a diving team will often carry out more than one duty, provided they are qualified and competent to do so and their different duties do not interfere with each other. Overlapping functions will need to be clearly identified in procedures.

Trainees will often form part of the team but will not normally be allowed to take over the functions of the person training them unless that person remains in control, is present to oversee their actions, and the handover does not affect the safety of the operation.

With regard to safe working practices, a single person should not work alone and this should be taken in consideration when establishing the minimum team size when undertaking work in hazardous activities such as:

- high voltage;

- heavy lifts;
- high pressure machinery;
- potential fire hazards – welding, burning, epoxy fumes, etc.

5.2.5.2 Minimum Team Size for Surface Supplied Air, Nitrox and Mixed Gas Diving

The absolute minimum team sizes required to conduct a dive within the scope of this code are as follows:

- surface supplied diving using air is five, consisting of: diving supervisor, working diver, standby diver, tender for working diver, tender for standby diver;
- surface supplied nitrox diving using pre-mixed nitrox stored in cylinders is five, consisting of: diving supervisor, working diver, standby diver and two tenders (*Ref. IMCA D 048*);
- surface supplied mixed gas diving is six, consisting of: diving supervisor and five personnel who are qualified to dive (*Ref. IMCA D 030*).

Additional personnel may be needed to operate or maintain specialised equipment, such as winches, to maintain diving equipment (see also section 5.1.7) and to assist in an emergency.

A risk assessment should be carried out to establish the actual team size and composition required based on the work to be carried out and duration, 12 or 24 hours operations, diving depth, and diving plant and equipment.

There is a requirement that one member of the dive team per shift, who is not diving (other than the supervisor), is trained as diver medic. This also needs to be taken in consideration. In practice, this means that at least two members who do not dive together, are trained as diver medics.

5.2.5.3 Minimum Team Size for Closed Bell Diving

An absolute minimum closed bell project requires two operations – one when the divers are in the bell or in the water under the control of a diving supervisor, and a second under a life support supervisor when the divers are in the saturation chambers.

The absolute minimum team size to support divers during a single bell run and 24 hours' life support operations is nine, consisting of: diving supervisor, two life support supervisors, two life support technicians, two divers inside the bell, one diver on the surface, and a tender for the surface diver. In addition to the above it may be appropriate for a relief diving supervisor to be available.

Additional personnel will be needed to operate winches and the umbilical, maintain specialised equipment and diving equipment (see also section 5.1.7) and to assist in an emergency.

A risk assessment should be carried out to establish the actual team size and composition required based on the work to be carried out and duration, 12- or 24-hours operations and diving depth.

There is a requirement that one member of the dive team per shift, who is not diving (other than the supervisor), is trained as diver medic. This also needs to be taken in consideration. For saturation diving, the diver medic may be a team member on the surface but needs to be qualified to go under pressure in an emergency.

In practice, this means that at least two members who do not dive together, are trained as diver medics.

5.3 Working Periods

5.3.1 General

It is recognised that long hours are sometimes required, but such circumstances should be exceptional and never planned. It should be remembered that accidents are more likely when personnel work long hours because their concentration and efficiency deteriorate and their safety awareness is reduced.

Work should be planned so that each person is normally asked to work for a maximum of 12 continuous hours and is then given a 12-hour unbroken rest period between shifts.

Members of the diving team will not be asked to work for more than 12 hours without having at least eight hours of unbroken rest during the previous 24 hours. Similarly, the longest period a person will be asked to work, and only in exceptional circumstances, will be 16 hours before being given eight hours of unbroken rest. This may be, for example, where a diving team has been on standby, but not diving, for a number of hours before diving is needed. In such cases, extreme care will need to be taken and allowance will need to be made for the effects of fatigue.

No person will be expected to work a 12-hour shift without a meal break taken away from their place of work. Personnel also need toilet and refreshment breaks during their shifts.

To allow for these breaks, the diving contractor will need to ensure that the planned work either has natural breaks (for example, during periods of strong tide) or that qualified and experienced personnel are available to act as relief during breaks. This is particularly important in relation to supervisors whose responsibilities are often onerous and stressful. Any such handovers of responsibility should be recorded in writing in the operations log.

Extended work periods offshore without a break can reduce safety awareness. Work will therefore need to be planned so that personnel do not work offshore for long periods without being allowed time onshore. These times may need to vary to suit operational needs or exceptional circumstances, but personnel should be given a reasonable onshore break related to the period spent offshore.

5.3.2 Saturation Diving

In saturation diving, the divers should not be asked to undertake a bell run exceeding eight hours from seal to seal. Divers should spend no more than six hours out of the bell and an allowance should be made for the divers to return to the bell for refreshments (see also section 6.6.7).

They will then need to be allowed at least 12 hours of unbroken rest.

For duration of saturation exposure see the guidance in section 6.6.6 and DMAC 21. This guidance should be followed unless national requirements are more stringent.

5.4 Training

It is necessary that diving contractors ensure that their personnel receive safety and technical training in order to allow them to work safely and in line with any relevant legislation, or to meet specific contractual conditions or requirements.

5.4.1 Safety Training

Safety training should include the following:

- courses on survival, first aid and fire fighting;
- an installation- or vessel-specific safety induction course on the hazards to be found at work and while responding to emergencies;
- further task-specific safety training outlining any special hazards associated with the tasks being worked on;

- refresher training at regular intervals.

5.5 Dive Control Simulators

Simulators are used for a variety of purposes. The use of simulators enables measurable assessment of individuals in training to be undertaken. Additionally, simulators are often used for work planning/mission planning purposes including engineering development, research and asset risk assessment.

IMCA guidance exists on the use of simulators (*Ref. IMCA C 014*). The guidance includes:

- ROV simulators;
- dive control simulators;
- DP simulators;
- offshore crane simulators.

Dive control simulator training can be used for training and competence assessment purposes such as:

- diving supervisor and life support technician training;
- work planning/mission planning and training;
- emergency training.

5.6 Language and Communications

In an emergency, personnel tend to revert to their own language. If team members do not speak the same language this can cause an obvious hazard. The diving project plan should state the language to be used during the project and all team members will need to be able to speak to each other fluently and clearly at all times, particularly during emergencies.

This is applicable to all lines of communications including, for example, diving operations, vessel/DP operations, crane operations and communications with third parties.

6 Medical and Health

6.1 Medical Equipment

A minimum amount of medical equipment will need to be at a diving site to provide first aid and medical treatment for the dive team. Medical equipment should be held in the diving bell, chambers and hyperbaric rescue facility. In addition, specialised medical equipment needs to be held at the dive site. The minimum amount will depend on the type of diving, but a standard list has been agreed (*Ref. DMAC 15*).

Diving medical specialists will then know what equipment and supplies are available when giving advice to a worksite. Particular problems exist if a diver becomes seriously ill or is injured while under pressure. Medical care in such circumstances may be difficult and the diving contractor, in conjunction with its medical adviser, will need to prepare contingency plans for such situations. Recommendations are available concerning the specialised equipment and facilities needed (*Ref. DMAC 28*).

Medical equipment needs to be stored in a sealed container, appropriately labelled and regularly inspected and maintained by a designated suitably qualified person, normally the diver medic.

The location of medical equipment will need to be identified by the international sign of a white cross on a green background.

6.2 Suitable Doctors

The physiology of diving and the problems encountered by an ill or injured diver are not subjects which most doctors understand in detail. For this reason it is necessary that any doctor who is involved in any way with examining divers or giving medical advice in relation to divers has sufficient knowledge and experience to do so (*Ref. DMAC 17*).

Diving contractors need to identify suitable doctors to carry out medical examinations of divers, and doctors who can provide advice on medical management of diving medical emergencies. Some countries have regimes in place for the approval of doctors to carry out medical examinations of divers.

A number of initiatives have seen diving contractors in particular regions mutually recognise doctors for diver medicals. IMCA has published such agreements, on its members' behalf, which are available on the IMCA website. Although IMCA publishes such information, IMCA does not approve or recognise any doctors for diving medicals.

DMAC 29 provides guidance for those who seek international approval for the recognition of courses in diving medicine for physicians. At present this recognition is available for only two specific types of courses that DMAC has selected as needed to medical support for working divers. They are for:

- Medical assessment of divers (Medical Examiner of Divers);
- Medical management of diving accidents and illnesses (Diving Medicine Physician).

Diving doctors who provide advice on diving emergencies should, when appropriate, be medically fit to go under pressure in a hyperbaric chamber.

6.3 First-Aid/Diver Medic Training and Competences

Diving physiology and medicine forms an integral part of all diver training courses. This qualification expires after a period of time. For diving within the scope of this code, divers will need to refresh their qualification at appropriate intervals.

Divers with diving first-aid certificates may choose to complete a general first-aid course rather than a diving-specific course.

In addition, one member of the dive team per shift who is not diving (other than the supervisor) will need to be trained to a higher standard of first aid known as 'diver medic'. In practice, this means that at least two team members, who do not dive together, are trained as diver medics. This level of training will also require refresher training (*Ref. DMAC 11, IMCA D 020*). From 1 July 2013 all certificates issued by IMCA diver medic recognised training establishments will be valid for two years instead of three years (*Ref. information note IMCA D 05/13*).

In order to maintain competence appropriate first aid and other emergency drills should be carried out on a regular basis (*Ref. IMCA C 013*).

For saturation diving, the diver medic may be a team member on the surface, but needs to be qualified to go under pressure in an emergency.

6.4 Medical Checks

All divers at work must have a valid certificate of medical fitness to dive issued by a suitable doctor. The certificate of medical fitness to dive must be renewed prior to expiring if a diver wishes to continue diving at work. If the examination is carried out during the last 30 days of the validity of the preceding medical then the start date of the new certificate will be the expiry date of the old certificate.

The certificate of medical fitness to dive is a statement of the diver's fitness to perform work under water and is valid for as long as the doctor certifies, up to a maximum of 12 months.

The medical examination looks at the diver's overall fitness for purpose. It includes the main systems of the body – cardiovascular system, respiratory system, central nervous system – and ears, nose and throat, capacity for exercise, vision and dentition.

6.4.1 Responsibility of the Diver

Divers who consider themselves unfit for any reason, e.g. fatigue, minor injury, recent medical treatment, lack of physical and/or mental fitness, etc., will need to inform their supervisor.

Even a minor illness, such as the common cold or a dental problem, can have serious effects on a diver under pressure and should be reported to the supervisor before the start of a dive.

Divers will also need to advise the supervisor if they are taking any medication.

Supervisors should seek guidance from their company or its medical adviser if there is doubt about a diver's fitness.

Only divers themselves know their own immediate health status at a given time and they have the responsibility for ensuring their fitness before making a dive. Divers who have suffered an incident of decompression illness will need to record details of the treatment they received in their logbooks. They will need to show this to the supervisor responsible for the first dive after the treatment in order that a check can be made of their fitness to return to diving (*Ref. DMAC 13*).

6.4.2 Responsibility of the Supervisor

Before saturation exposure, the supervisor will need to ensure that the divers have had a medical examination within the previous 24 hours. This will confirm, as far as reasonably practicable, their fitness to enter saturation. In addition, on completion of the saturation diving period a post-dive medical may be carried out. The medical examination will be carried out by a nurse or a diver medic. The content of the examination and the format of the written or electronic record will be decided by the diving contractor and will be specified in the contractor's diving manuals.

Before any dive not involving saturation, the supervisor will need to ask the divers to confirm that they are fit to dive and will record this in the diving records.

6.5 Liaison with a Suitable Doctor

The diving project plan and risk assessment will need to consider the situation where a diver is injured but a doctor is not available at the worksite. In such a circumstance, arrangements will be needed to allow personnel at the site to communicate over radio or telephone links with a diving medical specialist. It is the responsibility of the diving contractor to make such arrangements, before any diving operation commences, with a suitably qualified and experienced doctor (*Ref. DMAC 29*) such that medical advice and treatment is available at any time to the diving personnel offshore.

Such an arrangement is normally the subject of a 'standby' agreement with a doctor experienced in diving medicine and means that an emergency contact is available at all times for medical advice. This arrangement should be documented with the necessary details readily available offshore.

Part of the planning will need to be the pre-agreement of a suitable method for recording and transferring medical information from worksite to doctor (*Ref. DMAC 01*). All risk assessments and diving project plans will need to account for the fact that a seriously ill or injured diver in saturation cannot be treated as if the diver was at atmospheric pressure (*Ref. DMAC 28*).

If the required treatment cannot be administered by the personnel at the worksite, then trained medical staff and specialised equipment will need to be transported to the casualty. Treatment will be given to the injured diver inside the saturation chamber. The diver will not be decompressed or transferred to any other location until in a stable condition.

To enter a chamber a suitable diving qualification is not required by medical staff. They should, however, be examined and certified fit before entering the chamber (*Ref. DMAC 17*).

It is not normal acceptable practice to have someone in a compartment on their own during blow-down into saturation. This includes medical specialists in emergency situations.

6.6 Medical and Physiological Considerations

6.6.1 Diver Monitoring

For safety reasons, the diving project plan will need to specify that supervisors need to be able to monitor each divers' breathing patterns and receive verbal reports from the divers of their condition. There is no requirement to monitor the temperature, heart rate or other physiological parameters of the diver because this information will not assist the supervisors' assessment of safety (*Ref. DMAC 02*).

6.6.2 Seismic Operations, Sonar Transmissions and Piling Operations

There are inherent problems for divers who are close to seismic operations, sonar transmissions or piling operations (*Ref. DMAC 06, DMAC 12*). If there is any possibility of these activities being undertaken in the vicinity of a diving project, the diving project plan will need to include parameters for the safety of the diver.

6.6.3 Decompression Illness after Diving

Divers are at risk of decompression illness (DCI) after diving. It is difficult to treat decompression illness if recompression facilities are not immediately available. The diving project plan will therefore need to specify that divers remain close to suitable recompression facilities for a set time following a dive (*Ref. DMAC 22*).

6.6.4 Flying after Diving

The diving project plan will need to state that flying is avoided for a specified time (*Ref. DMAC 07*) following a dive because of the decrease in pressure on the diver's body caused by increased altitude.

6.6.5 Thermal Stress

The diving project plan will need to specify ways in which divers can be maintained in thermal balance because excessive heat or cold can affect their health, safety and efficiency. For example, divers may be provided with suitable passive or active heating, such as thermal undergarments and a well-fitting 'dry' diving suit, or a hot-water suit. Conversely in very warm waters nothing more than cotton overalls may be required.

For dives deeper than 150 metres, active gas heating, due to the high thermal conductivity of the oxygen and helium breathing mixture, should be available as an option for the divers.

6.6.6 Duration of Saturation Exposure

When planning a dive, consideration will need to be given to the previous saturation exposures of each diver and the time they have spent at atmospheric pressure since completing their last saturation dive.

Because of the effects of long periods under pressure on the diver's health, safety and efficiency the diving project plan should state that divers are not to be in saturation for more than a specified number of days (normally 28) including decompression and that they will need to be at atmospheric pressure for a specified period before starting another saturation (*Ref. DMAC 21*).

It is recognised that operational circumstances may require these artificial limits, particularly the time at atmospheric pressure, to be varied and this should be done in conjunction with the company medical adviser.

6.6.7 Divers Out of Closed Bells

Divers operating out of a closed bell over extended periods can suffer from dehydration. A diver spending over two hours out of a closed bell should be offered the opportunity to return to the bell and remove their breathing apparatus for a drink or other refreshments. While lack of food will not normally be a problem, a light snack when back at the bell can be helpful.

6.7 Noise and Fatigue

Under hyperbaric conditions a diver's hearing is more sensitive, and the noise of gas being injected into a diving bell or chamber, particularly when from a high-pressure source, may cause permanent damage to his hearing.

The following noise prevention/reduction measures should be considered:

- fitting gas inlets and outlets with a silencer;
- the use of suitable ear-protection to prevent hearing damage for divers under pressure if the noise exceeds acceptable levels. The use of noise protection equipment should not reduce the quality of oral communications.

During saturation diving fatigue arising from irregular work and rest patterns can affect efficiency and safety. Noise and traffic flow through and around the saturation complex should be kept to an absolute minimum so that divers get the best chance to rest and sleep.

6.8 Diet

Divers in saturation tend to lose weight and a programme for dietary management prepared by the diving contractor should offset this.

6.9 Saturation Diving Chamber Hygiene

During saturation diving infection is the most frequent medical problem. Therefore it is essential that measures to safeguard against infection are taken including (*Ref. DMAC 26*):

- personal hygiene;
- prevention of ear infection;
- chamber and equipment cleansing routines;
- environmental control.

7 Operational Planning

7.1 Diving Project Plan (DPP)

Before any diving is carried out there should be a diving project plan in existence. The diving project plan should consist of project specific documents such as:

- the risk management process for onshore planning and work preparations and at the worksite during execution, including HAZIDs/HIRA, JSA, toolbox talks, management of change and responsibilities of the relevant personnel;
- national, international and flag state standards, regulations, guidelines which have to be adhered to;
- health and environmental requirements in the country where the operations take place;
- health and security precautions to be taken;
- project safety management system (SMS) interface documents (bridging documents) agreed with all parties concerned;
- project personnel roles and responsibilities;
- communications and responsibility organograms;
- diving crew familiarisation plan and sign-off sheets;
- adverse weather working policy;
- diving/operating/maintenance procedures;
- mobilisation/demobilisation plans;
- risk assessments for mobilisation/demobilisation, the operation of the equipment and the contingency/emergency plans;
- detailed step-by-step work procedures inclusive of detailed procedural drawings;
- simultaneous operations (SIMOPS) procedures and matrix;
- contractor's manuals and documentation;
- code, standards and reference documents;
- accident/near-miss accident and incident notification, reporting and investigation procedures;
- deployment of divers and standby divers;
- diver umbilical management procedures when operating from DP vessels;
- equipment, tools and materials to be used and their deployment;
- equipment audit reports and certification;
- diving contractor and client permits to work system to be used;
- detailed drilling mud and chemical risk assessments;
- lift plans;
- minimum gas/breathing mixture requirements;
- suitable emergency and contingency plans, for the location(s)/countries where the work is going to be carried out, including: lost bell recovery; rescue of divers from a habitat; and hyperbaric evacuation for surface orientated and saturation diving operations, which should be agreed by all relevant parties;
- any location-specific hazards identified by the client.

See also section 10 for more details about a number of the above mentioned documents.

All supervisors will need to be familiar with and have ready access to the diving project plan. In addition, the divers, project team and supporting personnel should also have access to this information.

7.2 Risk Management Process

The diving contractor should have a risk management process in place which addresses the project lifecycle and should include the following:

7.2.1 Onshore

- Risk identification meetings (HAZID or HIRA) prior to commencement of the development of step by step work procedures;
- Final risk assessment (HAZID or HIRA) when the step by step work procedures have been finalised;
- Risk assessments of mobilisation/demobilisation plans and the contingency and emergency plans.

The risk identification and assessments (HAZIDs and HIRAs) will need to identify site-specific hazards, assess the risks and set out how these can be mitigated or controlled. The persons responsible for any actions will also need to be identified.

The meetings should be attended by experienced diving contractor engineering and offshore personnel as well as experienced client personnel.

7.2.2 Mobilisation

- Risk assessed mobilisation procedures and plans, and familiarisation of the offshore personnel;
- Prior to commencement of the mobilisation a JSA and toolbox talk with the diving contractor and sub-contractors personnel.

7.2.3 Offshore Operations

- A job safety analysis (JSA) should be completed prior to initiating the work. With the work procedures in place on the vessel/fixed/floating structure, all relevant persons responsible for the work should discuss the potential hazards and precautions to be taken. If the JSA reveals significant unanticipated safety risks then offshore acceptances should be withheld pending revision of the work procedure to address the safety concerns. Approval for the revision needs to be given by all parties concerned, onshore and offshore. Management of change procedures need to be followed (see section 10.7, *Ref. IMCA S&L 001*);
- A toolbox talk meeting should be held at the start of each shift or prior to any high-risk operation, where the diving supervisor and/or the diving supervisor's delegate and shift personnel discuss the forthcoming tasks or job and the potential risks and necessary precautions to be taken;
- Dive plan. This should be used for each dive to brief the divers. It should contain the tasks to be carried out, tools and equipment required, hazards, risks and precautions to be taken;
- Records detailing the shift handover;
- Records detailing familiarisation of personnel at crew changes.

7.2.4 Demobilisation

- Risk assessed demobilisation procedures and plans;
- Prior to commencement of the demobilisation a JSA and toolbox talk with the diving contractor and sub-contractors' personnel.

7.3 Operational and Safety Aspects

7.3.1 SCUBA

Self-contained underwater breathing apparatus (SCUBA) has inherent limitations and is not a suitable technique for diving under the scope of this code (*Ref. IMCA D 033*).

7.3.2 Surface Swimmers

Surface swimming should not be used where there is a requirement for a person to place his/her head underwater. Fully equipped divers operating in line with the recommendations of this Code should always be used in such circumstances.

Where the use of one or more surface swimmer is proposed, a risk assessment needs to take place to establish the precautions to be taken.

There must be a sufficient number of competent and qualified personnel to carry out the surface swimming operation. The absolute minimum team size required to support one surface swimmer within the scope of this code is five, consisting of: supervisor, swimmer, standby swimmer, tender of swimmer and tender of standby swimmer.

Appropriate personal protective equipment must be used. Any swimmer must be attached to an actively tended lifeline secured on the swimmer's harness by a lockable karabiner (or similar).

There must be a suitable means of access to and egress from the water as well as means to recover an injured or completely incapacitated swimmer safely. Suitable emergency response equipment must be available at the worksite location and ready to use (*Ref. information note IMCA D 08/19*).

7.3.3 Use of Compressed Air or Oxy-nitrogen Mixtures

Divers breathing a mixture of oxygen and nitrogen under pressure, whether compressed natural air or an artificial mixture, are at risk of both oxygen toxicity and nitrogen narcosis as the depth increases. The diving procedures will therefore need to specify the maximum depth for the mixture being used. Breathing mixtures other than oxygen and nitrogen (or air) will need to be used when diving takes place deeper than 50 metres of water.

When nitrox diving is carried out the oxygen partial pressure should not exceed 1.4 bar absolute (*Ref. IMCA D 048*). This does not apply to therapeutic recompression treatment.

7.3.4 Exposure Limits for Air and Oxy-nitrogen Diving

Diving carries an inherent risk of decompression illness (DCI). In surface supplied diving the incidence of DCI drops if the length of time a diver spends at any particular depth is limited.

It is recommended that diving using air should be organised in such a way that the planned bottom time does not exceed the limits outlined in Appendix 2.

If a nitrox breathing mixture is being used, the maximum exposure can be found by entering the equivalent air depth (EAD) of the maximum dive depth in the table.

It should be remembered that any subsequent dive within 12 hours of surfacing (repetitive diving) may not be allowed by some decompression tables and will be restricted in others (*Ref. IMCA D 048*).

7.3.5 Surface Supplied Air Diving

During surface supplied diving, divers need to be able to enter and leave the water safely and in a controlled manner.

On a vessel/floating structure, where the freeboard is less than 2 metres, a risk assessment should be carried out to establish if there are any obstructions that could be dangerous for diver(s) and standby diver(s) and to identify which diver/standby diver launch and recovery system should be used. In addition, the environmental conditions at the worksite should also be taken in consideration.

1) When diving from an anchored vessel/floating structure where there are no hull obstructions near the diving site and the freeboard is less than 2 metres, then either one or other of the following options should be fitted:
   - a wet bell or diving basket(s) and equipment for the deployment of a surface standby diver; or
   - a ladder which extends at least 2 metres below the surface in calm water. The ladder should have sufficient holds under and above water and on deck level to allow the diver to step easily onto the deck. In addition a dedicated arrangement, e.g. a crane, A-frame or davit, certified for man-riding, with sufficient reach should be present to recover an incapacitated diver from the water by, for example, their safety harness onto the deck.

The equipment used, including launch and recovery systems, should meet the minimum requirements for diving equipment as laid out in IMCA D 023.

2) When diving from a DP vessel or an anchored vessel/floating structure where there are obstructions at the diving site and/or a freeboard of more than 2 metres then either one or other of the following options should be fitted:
   - wet bell and in addition equipment for deployment of a surface standby diver; or
   - two diving baskets – one for the diver(s) and one for the standby diver.

The equipment used, including launch and recovery systems, should meet the minimum requirements for diving equipment as laid out in IMCA D 023.

7.3.6 Surface Supplied Mixed Gas Diving

The diving contractor may wish to carry out work using surface supplied techniques but where the use of compressed air or oxy-nitrogen mixtures would not be appropriate. The normal solution is to use a mixture of helium and oxygen as the breathing gas.

The technique has limitations and due to the inherent risks involved, this type of diving should be conducted within the following parameters (*Ref. IMCA D 030*):

- a properly equipped wet bell is required for surface supplied mixed gas diving (*Ref. IMCA D 037*);
- maximum depth should be limited to 75 metres of water;
- for depths between 0 and 50 metres, the bottom time should be limited such that the in-water decompression required is less than 100 minutes;
- for depths between 50 and 75 metres of water the bottom time should be limited to a maximum of 30 minutes.

The diving project plan for such work will need to consider all the relevant safety implications of using this technique instead of the use of a closed bell. In particular, divers and supervisors will need to be experienced in this type of diving.

7.3.7 Water Intakes and Discharges

Divers are vulnerable to suction or turbulence caused by water intakes and discharges as well as discharge products. The diving contractor will need to establish with the client whether there are any underwater obstructions or hazards in the vicinity of the proposed diving project. If there are any intakes or discharges, suitable measures will need to be taken to ensure that these cannot operate while divers are in the water unless the divers are protected with a suitable physical guard. Such measures will need to be part of a work control system, such as a permit to work system, and could include mechanical isolation (*Ref. AODC 055*).

7.3.8 Restricted Surface Visibility

Restricted surface visibility caused by, for example, driving rain or fog may affect the safety of the operation.

The risks to be considered are (*Ref. AODC 034*):

- safety of surface personnel;
- rescue of a diver who surfaces in an emergency;
- rescue of a diving bell which has surfaced in an emergency;
- safety of the surface vessel;
- access for medical assistance.

The diving project plan will need to identify when operations will need to be suspended because of restricted visibility.

7.3.9 Underwater Currents

The diving project plan will need to consider the presence of currents and the limitations they impose on the diver's operational ability.

When planning diving operations in the presence of current conditions the diving method to be used needs to be considered. A diver operating from a bell or wet bell is better able to operate in currents than a surface orientated diver since his umbilical is shorter, is deployed in the horizontal plane and therefore attracts much less resistance to water movements.

An indication on the effects of current conditions on various types of diving operations is available (*Ref. AODC 047*).

While other parameters also need to be taken into account, tide meters provide accurate information on the current at different depths and can be used to assess the diving conditions.

7.3.10 ROV Operations Near or in Close Support of Divers

Where an ROV is proposed a risk assessment needs to take place to establish the precautions to be taken.

There are a number of safety considerations that need to be taken into account when divers are working with, or in the vicinity of, ROVs. These include entanglement of umbilicals, physical contact, electrical hazards, etc. The diving project plan will need to include mitigation of these hazards. For example, umbilicals could be restricted in length and electrical trip mechanisms could be employed. All ROV thrusters should be fitted with thruster guards (*Ref. IMCA D 045, AODC 032 (being revised), IMCA R 004*).

7.3.11 Safe Use of Electricity

Divers often come into contact with equipment operated by or carrying electricity. Care will need to be taken, therefore, to ensure that the divers and other members of the dive team are protected from any hazards resulting from the use of electricity and particularly from any shock hazard (*Ref. IMCA D 045*).

Battery-operated equipment used inside compression chambers can also be a hazard and the diving project plan will need to include safe parameters for using such equipment (*Ref. IMCA D 041*).

7.3.12 High Pressure Water Jetting

Even an apparently minor accident with this equipment has the potential to cause a serious internal injury to the diver. A work procedure that includes the use of such units will therefore also need to include safe operating procedures that will need to be followed. Such procedures can be found in industry guidance (*Ref. IMCA D 049, DMAC 03*).

7.3.13 Lift Bags

The use of lift bags under water can be hazardous. The diving project plan will need to include ways to prevent the uncontrolled ascent of a load. Good practice established by the industry should be followed (*Ref. IMCA D 016*).

7.3.14 Abrasive Cutting Discs

The diving project plan will need to address the risk of abrasive cutting discs breaking during use under water. In particular, the adhesive used in these discs tends to degrade in water. The plan will need to ensure that only dry discs not previously exposed to water are used and that only enough discs for each dive are taken under water at any one time.

7.3.15 Oxy-arc Cutting and Burning Operations

There are inherent hazards in the use of oxy-arc cutting and burning techniques under water, including explosions from trapped gases, trapping of divers by items after cutting, etc. Guidance on this subject exists. The diving project plan will need to include precise instructions regarding the operating procedures. Appropriate procedures will need to be employed (*Ref. IMCA D 045, IMCA D 003, OGP Report No. 471*).

7.3.16 Diving from Installations

A specific evacuation plan will need to be in place when surface orientated diving or saturation diving is carried out from fixed installations (*Ref. IMCA D 025*).

7.3.17 Diving from DP Vessels/Floating Structures

Diving from dynamically positioned vessels/floating structures can be hazardous to divers because of the presence of rotating propellers and thrusters. Practical steps have been established to reduce the risks arising from this hazard and these will need to be included in the diving project plan (*Ref. IMCA D 010*).

An ROV or some other way of carrying out the task should be used if the possibility of an umbilical or diver coming into contact with a thruster or propeller cannot be discounted.

The diving project plan will need to ensure that any diving support vessel/floating structure operating on dynamic positioning meets industry technical and operational standards (*Ref. IMCA M 103, 127 DPVOA, IMCA M 117, IMCA M 178, 113 IMO*).

7.3.18 Quantity of Gas

The likely quantities of gases needed for diving operations, including therapeutic treatments and emergencies, will need to be calculated when planning a diving project. Allowances will also need to be made for leakage, wastage, contingencies, etc. *(Ref. IMCA D 050).* Diving will need to be stopped if the minimum quantity of gas acceptable for safety purposes falls below the agreed minimum specified in the diving project plan.

7.3.19 Levels of Oxygen in Helium

For safety reasons, pure helium should not be sent offshore except as a calibration gas or for a specific operational requirement. A small percentage of oxygen will need to be present in helium to be used within the scope of this code. The industry norm is 2%. For water depths of 150 metres or below a lower percentage may be appropriate (*Ref. DMAC 05, AODC 038).*

When an oxy-helium mixture is used as the reserve supply in a diver's bail-out bottle, it should contain a percentage of oxygen that allows it to be breathable over the largest possible depth range. Guidance on a suitable percentage exists (*Ref. DMAC 04*).

7.3.20 Contents of Gas Mixes

Gas cylinders containing breathing gases coming from suppliers should be colour coded in accordance with industry guidance (*Ref. IMCA D 043*) and will be accompanied by an analysis certificate. The diving project plan will need to make it clear that neither of these should be accepted as correct until a competent member of the dive team has analysed at least the oxygen content. This analysis will need to be repeated immediately before use of the gas.

7.3.21 Length of Divers' Umbilicals and Divers' Bail-out

The required length of divers' umbilicals in relation to the worksite will need to be included in the diving project plan.

Factors which should be considered when deciding on the length of the umbilical are:

- the distance of the job from the proposed bell/wet bell/diving basket/diving ladder location;
- the duration of the diver's bail out bottle at the depth. In the event of loss of gas supply, the diver needs to be able to return to the bell/wet bell/diving basket/diving ladder and on deck using his bail-out bottle and this may dictate the distance he is away from the bell/wet bell/diving basket/diving ladder. Note: The diameter of the bell manway should be considered when sizing the bail-out bottle, as this will dictate the diver's ease of entry into the bell;
- when calculating the duration of the bail-out the breathing rate in an emergency is normally taken as about 40 litres per minute to allow for the effects of cold shock and apprehension. Some companies and national legislation use higher emergency breathing rates. The calculation should take into account the available pressure of gas in the bail-out bottle after deductions for depth and working pressure of the regulator (*Ref. IMCA D 022*);
- the type of umbilical, its bulk and buoyancy. A long length of negatively buoyant umbilical will act to drag a diver down, while a bulky umbilical in current may have a similar effect;
- the condition of the worksite, including debris, rocks or other obstructions which could hinder the diver's return to the bell in an emergency.

Each operation should be considered on its merits and the length of a diver's umbilical determined on the above and other factors relevant to the particular circumstances.

In an emergency the bellman may need to pay out more umbilical than the pre-determined maximum length and for this purpose 'spare' umbilical inside the bell, but lightly tied off to prevent routine use, is desirable.

In all operations the bellman/stand by diver's umbilical should be at least 2 meters longer than the diver's.

When diving is being carried out from a dynamically positioned vessel/floating structure, the diving project plan in addition will need to consider the fouling and snagging hazards in relation to umbilical length. It should also include (*Ref. IMCA D 010*):

- the minimum distance requirements identified by risk assessments to physical hazards (such as vessel thrusters, propellers, water intakes, etc.);
- maximum umbilical length for the diver and standby diver at various depth.

7.3.22 Duration of Bell Runs and Lockouts

The diving project plan will need to limit bell runs to less than eight hours from 'lock-off' to 'lock-on' because of decreased safety and efficiency. The diving project plan will also need to ensure that each diver spends no more than six hours out of the bell *(Ref. DMAC 20).*

The diving project plan will need to state that divers in saturation need to be given at least 12 continuous hours of rest in each 24-hour period (see also section 5.3).

7.3.23 Transfer Under Pressure

The transfer of divers or equipment into or out of the saturation chamber, or between chambers under pressure, introduces a particular hazard. The diving project plan will need to state that internal doors, i.e. those between the transfer chamber and the trunking to the diving bell and those separating living chambers within the chamber complex, are to be kept closed and sealed at all times except when divers are actually passing through them.

7.3.24 Underwater Obstructions

Diving operations can be complicated by the number of lines deployed during operations: DP taut wire, equipment guidelines, clump weights and wires, divers' and bell umbilicals, swim lines, etc. This situation is however often simplified by the level of detailed planning involved in the operation, resulting in all involved parties having a clear understanding of responsibilities and expectations (*Ref. IMCA D 010*).

7.3.25 Over-side Loads/Scaffolding and Working

Dropped loads and scaffolding pose a serious risk to divers. Therefore no over-side working should take place from structures and no crane lifts transferred over the side when diving is taking place and while divers are in the water unless a safe horizontal separation between divers and the above activities is maintained.

The hazards of over-side loads/scaffolding need to be addressed during the onsite job safety analysis (*Ref. IMCA D 007*).

7.3.26 Effluent and Waste Dumping

When diving operations are taking place the dumping of industrial effluent in the vicinity should be avoided. Such activities could reduce the effectiveness of divers by obscuring their vision, could cause them skin infections, or could result in potentially harmful chemicals being carried back into a saturation diving bell or complex. Some industrial effluents may be considered harmless under normal conditions, but their toxic affect on the human body may change under pressure (*Ref. IMCA D 021*).

7.3.27 Diving Operations in the Vicinity of Pipelines

Divers should not be permitted to work on a pipeline system which is under test. When the line is suspected of being damaged or defective divers should not approach the line until its internal pressure has been reduced to a pressure which has been established as safe through a full engineering and hazard assessment (*Ref. IMCA D 006*).

7.3.28 Diving on Depressurised or Empty Pipelines/Hoses/Subsea Structures

When diving on depressurised or empty pipelines/hoses/subsea structures, care needs to be taken to ensure that a diver will not get trapped and/or injured due to negative pressure. A risk assessment needs to be carried out to establish the risks and precautions to be taken when work is planned to be carried out on depressurised or empty pipelines/hoses/subsea structures. When new lines/hoses need to be flooded, consideration should be given to undertaking any intervention using an ROV or another remote system. When divers are used for opening the flooding valve, as a minimum, a diffuser needs to be installed which will prevent a diver getting trapped or injured.

7.3.29 Diving on Wellheads and Subsea Facilities

Whenever divers are required to work on part of a subsea system relevant risk assessed system isolations should be in place. This is to ensure the safety of the diver prior to conducting intrusive works on any energy-conveying system in which pressure differentials, electrical power or laser power may exist at levels which – on loss of containment – would be harmful to personnel or cause damage to the environment or equipment *(Ref. IMCA D 044)*.

System isolations include:

- liquid and gas equipment;
- electrical equipment;
- optical equipment;
- hydraulic equipment.

Guidance is also available on diving operations on wellheads and subsea facilities (*Ref. IMCA D 019*).

7.3.30 Impressed Current Systems

Impressed current systems may be installed to protect vessels, structures or pipelines against corrosion by means of electrically supplied anodes in the sea which protect the parent structure.

The client is obliged to provide the diving contractor with information whether such a system is installed. As part of the risk assessment, contractors carrying out diving in the vicinity of an impressed current system should follow the advice given in IMCA D 045. Depending on the voltage of the system and the proximity to the divers, the system may need to be switched off.

7.3.31 Diving Under Flares

It may be necessary to locate the diving vessel close to the flare of an installation for certain tasks. The heat and fallout could have an adverse effect on topside personnel and equipment in proximity to the flare. Should work be required under or in close proximity to the flare a study/review should be carried out to establish a safe location, given the output from the flare, wind speed and direction. This should be included in the work procedure.

7.3.32 Detection Equipment When Diving in Contaminated Waters

When diving in contaminated waters or waters which may become contaminated as result of underwater activities, the use of appropriate gas detection equipment should be considered to identify any contaminations entering a closed diving bell, which could affect the divers (*Ref. IMCA D 021*).

7.3.33 Hazardous Substances and Mud/Cuttings from Drilling Operations

The client is obliged to provide the diving contractor with details of any possible substance likely to be encountered by the dive team that would be a hazard to their health, for example drill cuttings on the seabed. This information must be provided in writing and in sufficient time to allow the diving contractor to carry out the relevant risk assessment and, if necessary, to take appropriate action such as the use of protective clothing (*Ref. IMCA D 021*) (see also section 3.2).

7.3.34 Naturally Occurring Radioactive Materials (NORM)

NORM is sometimes referred to as low specific activity (LSA) material. The oil company needs to advise the diving contractor if naturally occurring radioactive material (LSA scale) is present in pipelines, flowlines, subsea trees and manifolds, sea-water pumps and other equipment the diving contractor personnel have to work on. This information needs to be provided in writing, including the risk level, and in sufficient time to allow the diving contractor to carry out the relevant risk assessment, take the necessary precautions and provide training for personnel (*Ref. IMCA SEL 024, OGP Report No. 412*).

7.3.35 Simultaneous Operations (SIMOPS)

During SIMOPS there may be activities that could lead to an increased exposure to, or frequency of, hazards to personnel, environment and/or equipment.

Prior to SIMOPS taking place involving diving operations, a hazard identification and risk assessment should be carried out to assess measures which have to be taken when two or more operations are performed concurrently and to ensure mitigation of potential hazards to a level that is as low as reasonably practicable.

A SIMOPS safety management interface document and a matrix should be developed which shows, amongst other things, which other activities can take place concurrently during diving operations and what precautions have to be taken.

IMCA guidance on marine operations SIMOPS is available (*Ref. IMCA M 203*).

7.3.36 Diver and ROV Based Concrete Mattress Handling, Deployment, Installation, Repositioning and Decommissioning

There are inherent dangers when handling, installing and recovering concrete mattresses, in particular in poor visibility. When concrete mattresses are installed by divers it is normally done by two divers with helmet-mounted cameras and lights and supported by a monitoring ROV. IMCA guidance is available including safety precautions to be taken (*Ref. IMCA D 042*).

7.3.37 Permits to Work

A 'permit to work' should be raised when divers have to work on installations, pipelines and subsea facilities. This is to ensure that any operation of plant or equipment that may put the diver at risk, for example, by creating suction at intakes close to the worksite, exposure to electrical current, release of pressure, ejection of effluent or a powerful flow of water, or any other harmful effect, is isolated or immobilised.

On a vessel/floating structure a 'permit to dive' system which identifies the controls and conditions should also be in place before diving operations are allowed to commence.

7.4 Environmental Considerations

The safe and efficient deployment and operation of divers is dependent upon suitable environmental conditions. For any given situation the combination of these conditions can be dramatically different, and it is the responsibility of the diving supervisor to assess all available information before deciding to conduct, to continue or to finish diving operations. Each diving contractor should define clear environmental limits (adverse weather working policy). Diving supervisors should also ensure that they understand the implications of any other limitations which apply to vessels/fixed and floating structures and deployment systems.

At no time should a diving supervisor allow contractual pressure to compromise the safety of personnel during diving operations.

The following sub-sections are designed to highlight environmental aspects that affect diving operations. There is not, however, any substitute for practical experience.

7.4.1 Water Depth and Characteristics

Water characteristics may have a significant effect and the following factors should be taken into account when assessing the use of a diver on a given task.

7.4.1.1 Visibility

Poor visibility can alter the effectiveness of the operation. Diving operations near or on the bottom can stir up fine grained sediment which may reduce visibility, particularly in low or zero current situations.

7.4.1.2 Temperature

Extreme temperatures (both high and low) may affect the reliability of equipment and impose particular hazards on personnel.

7.4.1.3 Pollutants

The presence of man-made and natural petroleum products around oil fields can cloud optical lenses and may damage plastic materials. Equally, gas can affect visibility, block sound transmission and cause sudden loss of buoyancy. Special precautions should be taken to protect the divers if pollutants are present and prevent these pollutants from entering the diving bell, as well as protecting personnel who may handle the divers or their equipment during launch/recovery and during maintenance (*Ref. IMCA D 021*).

7.4.1.4 Water Movement

Divers are very sensitive to water movement and great care has to be taken in shallow water where surge of the water or the proximity of vessel/floating structure thrusters can have a major effect on the ability of a diver to remain in a particular position (*Ref. AODC 047*).

7.4.2 Currents

Currents can cause considerable problems in diving operations (*Ref. AODC 47*) but unfortunately it is often the case that very little quantitative data on particular current profiles is available.

Simulations and analysis can provide good indications of the effect of currents but often currents are not constant even close to the seabed. Currents vary with location and surface currents can be quickly affected by wind direction.

The use of a tide/current meter may provide information on the current strength and direction at any particular depth (see also section 7.3.9).

7.4.3 Sea State

The sea state can affect every stage of a diving operation.

Working from a support vessel/floating structure in rough seas requires careful consideration of safety before and during launch and recovery.

Rough seas also require a heightened awareness of the possibility of accidents during recovery, both to the surface crew and to the divers. It is important, particularly in adverse sea states, that all personnel involved with launch and recovery wear all necessary personal protective equipment (PPE) and fully understand their own role as well as the role of others involved in the operation, such as the captain of the support vessel. Good communication is a vital factor in reducing the possibility of accidents.

In certain situations, purpose-built deployment systems, e.g. motion compensation systems, can either reduce or better accommodate the effect of wave action thereby enabling diving operations to be conducted in higher than normal sea state conditions while maintaining normal safety standards.

7.4.4 Weather

The cost and efficiency of operations can be adversely altered by the effects of weather. Local weather forecasts should be consulted before commencing any diving operation.

While divers under water may not be directly affected by the various effects of weather, these can have an effect on diving operations in a number of different ways:

- Wind speed and direction can make station-keeping difficult for the support vessel/floating structure;
- Rain and fog will cause a reduction in surface visibility, possibly creating a hazard for the support vessel/floating structure and diving operations (*Ref. AODC 34*) (see also section 7.3.8);

- Bad weather can make working on deck extremely hazardous for the diving crew, particularly with adverse combinations of wind, rain, snow, etc.;
- Hot weather can cause overheating. In particular, umbilicals stored on deck are more susceptible to overheating by warm air or direct sunlight;
- Extreme heat, including direct sunlight, or cold can cause the temperature inside deck chambers to rise or fall to dangerous levels. In such conditions the internal temperature should be monitored and kept at a comfortable level;
- Extreme heat, including direct sunlight, or cold can adversely affect divers acting as standby divers who will be static but dressed in most of their diving equipment. Arrangements should be made to keep the standby diver sheltered, at a comfortable temperature and well hydrated;
- Electric storms or lightning may be a hazard to exposed personnel or equipment.

Operations should, therefore, be carefully monitored with regard to the safety of both personnel and equipment.

7.4.5 Diving in Arctic Conditions

Special precautions need to be taken when carrying out diving operations in cold climates globally including Arctic/Antarctic regions.

The diving contractor should have in place a cold weather policy which should include:

- appropriate operating procedures;
- documented risk assessment identifying the hazards;
- appropriate control measures which have been put in place.

Guidance on factors to be considered for both above and underwater, maintenance, survival equipment, emergency and contingency plans, firefighting and personnel is being developed.

7.4.6 Hazardous Marine Life

In some parts of the world divers may come into contact with marine life which will pose a hazard. Prior to commencing diving operations, it should therefore be established if there is any known local hazard of this type and this should be taken into account during the risk assessment.

If hazardous marine life is suspected, then suitable emergency and contingency plans should be drawn up to deal with its effects.

7.4.7 Other Considerations

A diving supervisor should only allow a diving operation to begin after careful consideration of all possible environmental criteria, their interaction with each other, and other factors including the deployment equipment, the system's readiness, crew readiness and the nature and urgency of the tasks. This should form part of the risk assessment and JSA carried out for that operation.

7.5 Communications

Effective communications are essential to ensure that all personnel directly involved in operations are made fully aware of the work being undertaken and that during operations all parties are kept aware of the status of any unusual situation.

Communications between the diving team and any other relevant personnel (such as marine crew, DP operators, crane drivers) are important to safe and efficient operation (*Ref. IMCA M 103, IMCA M 205, IMCA D 023, IMCA D 024, IMCA D 037, IMCA D 040, IMCA D 053*).

On a DP diving support vessel/floating structure, in addition to the primary and secondary means of voice contact between the bridge and diving supervisor, there also needs to be a set of DP alarms in the diving control centre.

If there is an ROV operation taking place in the vicinity (*Ref. AODC 032 (being revised)*) (see also section 7.3.10) established communications should always exist between the:

- diving supervisor and the ROV supervisor (when an ROV is used in a diving operation the diving supervisor has ultimate responsibility for the safety of the whole operation);
- diver and the ROV operator (Note: This is normally routed through the diving supervisor). If the ROV is used to monitor the diver, then back-up hand signals should be rehearsed.

Effective communications are vital to the safety and success of any operation. To ensure this the diving supervisor needs to be given access to the communications service of the vessel or fixed/ floating structure on which operations are based, as and when required.

Communication systems encompass all available media and equipment: word of mouth, reports, telephone, telex, email, fax, radio, etc.

7.6 Diving from Vessels, Fixed Platforms or Floating Structures

7.6.1 General

Divers may work from a variety of locations ranging from very small boats to large fixed installations or structures.

Vessels used to support diving operations may be purpose-built or modified, or they may be vessels of opportunity. Whichever type is to be used it should hold a certificate of class awarded by a recognised classification society and meet IMCA, IMO and national/flag state regulations/standards and the requirements for safe diving regardless of any other role which it may also be required to undertake.

IMCA D 035 makes recommendations about the selection of vessels of opportunity for diving operations. Prior to mobilisation it is recommended that a suitable person (this may be the diving supervisor) should inspect the site and decide on the optimum location for the diving system. The level of services should also be assessed.

Guidance is also available on vessel assurance (*Ref. IMCA M 204*).

Diving should only be carried out from vessels or floating structures which are stationary by means of anchors or a combination of anchors and mooring ropes or which maintain position using a dynamic positioning (DP) system. For diving operations only DP with IMO equipment class 2 or 3 should be used, which means that these vessels are designed so that a loss of position should not occur in the event of a single fault in any active component or system (*Ref. IMCA M 103, IMCA D 010, 113 IMO*).

All vessels should also be audited on a yearly basis using the Common Marine Inspection Document (CMID) (*Ref. IMCA M 149*).

7.6.2 Live-boating

'Live-boating', which is the practice of supporting a diver from a non-DP vessel which is under power and making way, should not be used.

7.6.3 Small Work Boat, Supply Boat or Standby Vessel

The smallest type of vessel used in offshore diving operations is a small craft for mobile or portable surface supplied systems. IMCA D 015 and IMCA D 040 make recommendations about the equipment and crewing of such craft. In all cases, these craft will be working from a larger support vessel or support location and should remain within close vicinity and in line of sight at all times. They are restricted to operating in good weather and good visibility. Sea conditions need to be such that the diver can safely enter and leave the water and that the craft can be safely launched and recovered by the support vessel.

Small work boats, supply boats or standby boats may be used in certain operations. These vessels are not specifically designed for diving operations and have a number of limitations:

- lack of manoeuvrability;
- low grade navigation systems;
- very low capability offshore mooring or position keeping systems;
- minimal deck space;
- no, or very low capacity, crane facilities;
- low electrical power reserves;
- limited personnel accommodation;
- poor weather susceptibility for over-side operations;
- lack of marine crew familiarity with diving operations.

These limitations need to be taken into account when considering the work scope and location of the vessel. Guidance on the basic marine inspection template for small workboats is available (*Ref. IMCA M 189*).

7.6.4 Small Air Range Diving Support Vessels and Larger Supply Boats

These vessels can be convenient for diving operations and while they will normally not have all the limitations listed in section 7.6.3, they will still have some of these limitations.

Again, such vessels can be used in a number of situations, but they still need to be carefully assessed prior to the project to ensure that the limitations of the vessel are nevertheless acceptable in relation to the proposed work scope and envisaged environmental considerations.

Often, the vessel's crew will be familiar with diving operations which can be very advantageous in difficult operating conditions or in an emergency.

7.6.5 Purpose-Built Diving Support Vessels (DSVs)

Such vessels are relatively expensive in comparison to other vessels due to the range of capabilities they can provide, such as the capability to operate air and saturation diving simultaneously. ROVs may also operate from such DSVs to assist divers and carry out underwater tasks.

7.6.6 Fixed Platforms

While the fixed nature of an installation results in the absence of a number of the limitations imposed by floating structures, there are a number of specific problems associated with operating from a fixed platform such as:

- the need to comply with specific, often onerous, zoning requirements in relation to hydrocarbon safety;
- space or weight limitations leading to difficulty in installation of surface support equipment;
- additional safety requirements imposed on personnel such as training in H_2S emergencies;
- the possibility of a power shutdown due to an emergency automatic tripping of platform non-essential equipment;
- tidal effects on the diver making relocation difficult;
- deployment and recovery may be complicated by the height between the platform and sea level;

- additional hazards resulting from operations undertaken inside the platform structure;
- emergency evacuation (*Ref. IMCA D 025*);
- intakes and outfalls.

In addition, all platforms operate a permit to work system which governs the operation of diving systems and may result in operational delays.

7.6.7 Temporarily Fixed Platforms

Included in this category are various large structures which may in themselves be mobile but are intended to remain in one location during work. They may be maintained in that location by moorings, DP systems or other means. Examples would be drilling rigs, crane barges, accommodation barges, FPSOs, etc. These may present to diving operations similar hazards to those of a fixed platform and while zoning and hydrocarbon safety requirements will normally apply to drilling rigs and FPSOs, other types of platform may have no such limitations.

These platforms may, however, have other hazards to diving operations such as anchor wires, DP systems, propellers and submerged pontoons (*Ref. IMCA D 010*).

7.6.8 Specialist Locations

These can include multi-support vessels (MSVs), lay barges, trenching barges or specialised marine vessels.

Every specialist location will present different problems which will need to be carefully considered at the planning stage. On many specialised vessels one of the main limitations on diving operations is that the primary task, for example pipelaying, cannot be interrupted without serious consequences.

It is important that all diving operations being conducted from a specialist location are planned to conform to a set of procedures agreed specifically for that location with the client (*Ref. IMCA D 010*).

7.6.9 Dynamic Positioning

Many of the above types of support location can be held in a fixed position by the use of dynamic positioning.

DP vessels and floating structures use position reference systems (e.g. differential global positioning systems (DGPS), taut wire, hydroacoustic positioning references (HPR), Artemis, Radius and fan beam laser). These are used to determine the vessel's/structure's actual location with respect to the seabed and other sensors such as gyros, vertical reference units, wind speed and direction sensors to determine heading, pitch and roll measurement and the forces acting on the vessel. All this data is used by the computer to calculate the force and direction needed to be output from the thrusters to automatically keep the vessel in position. The DP console provides the interface between the computer and the DP operator.

When diving operations are carried out from a DP vessel or floating structure the DP system needs to be arranged in a redundant configuration so that failure of any part of the system essential to station keeping will not cause loss of position. To confirm this is the case an FMEA and FMEA proving trials need to be carried out which should be updated when any changes to the DP system take place (*Ref. IMCA M 103, IMCA M 166, IMCA M 178, 113 IMO*).

In addition, annual DP trials need to be carried out (*Ref. IMCA M 190, IMCA M 212*).

Dynamic positioning has its own inherent limitations and hazards in relation to diving operations:

- No system keeps the vessel or floating structure static. It allows it to move in a predetermined 'footprint'. Although DP systems are very reliable, all have the possibility of failure (*Ref. 115 DPVOA, 121 DPVOA*);

- DP uses the thrusters and propellers at all times, which means that divers and their umbilicals can be at risk from these items or the wash that they generate (*Ref. IMCA D 010*).

For the above reasons, it is important that a thorough assessment is carried out prior to the offshore operation to establish what the capabilities and limitations are of the DP system on the proposed vessel or floating structure. This can then be compared with the required scope of work and a decision made about suitability and any restrictions which may need to be put on the operation.

Only vessels and floating structures complying fully with all aspects (such as number of reference systems, levels of redundancy, crew competency, etc.) of IMCA guidelines and IMO requirements should be used (*Ref. 127 DPVOA, IMCA M 206, IMCA M 103, IMCA M 117, IMCA M 212, IMCA M 140, IMCA M 166, IMCA M 178, 113 IMO*).

IMCA D 010 provides further guidance on diving operations from vessels in DP mode.

7.7 Launch and Recovery Procedures and System Certification

Because of the variety of diving systems, support locations and deployment systems, it is not possible to define every launch/recovery procedure and system in this document.

It is the responsibility of the diving supervisor to ensure that a safe launch/recovery procedure exists that is understood by all members of both the diving and the support installation crews. The procedure should progress in smooth, logical steps and be designed so that all personnel involved in the operation are fully aware of the situation at all times.

A diving contractor should ensure that the launch and recovery system(s) used for diving operations have been tested and certified by a competent person (*Ref. IMCA D 018, IMCA D 004, IMO Code of Safety for Diving Systems 1995 Resolution A.831(19), IMO Guidelines and Specifications for Hyperbaric Evacuation Systems Resolution A.692(17), IMCA D 053*).

8 Hyperbaric Evacuation of Saturation Divers

8.1 General

In an emergency, divers in saturation cannot be evacuated by the same methods as other crew members. For all saturation diving operations a hyperbaric evacuation system (HES) needs to be provided that, in the event of a vessel or fixed/floating installation evacuation, is capable of evacuating the maximum number of divers that the dive spread is capable of accommodating, to a designated location where the divers can be decompressed in a safe and controlled manner, taking in consideration the geographical location and weather conditions.

The HES includes the whole system set up to provide hyperbaric evacuation. It includes the planning, procedures, actual means of evacuation, reception facility, contingency plans, possible safe havens and anything else involved in a successful hyperbaric evacuation (*Ref. IMCA D 052*).

The equipment that supports the hyperbaric evacuation arrangements includes:

- hyperbaric rescue unit (HRU) – this can be a self-propelled hyperbaric lifeboat (SPHL) or hyperbaric rescue chamber (HRC);
- life support package (LSP);
- hyperbaric reception facility (HRF), if applicable.

8.2 HRU Life Support Capability

The HRU should be capable of maintaining the divers at the correct pressure and with life support for a minimum of 72 hours (*Ref. IMO Guidelines and Specifications for Hyperbaric Evacuation Systems Resolution A.692(17)*).

8.3 HRU Launch to Safe Decompression Phases

There are four distinct phases from the decision to launch the HRU until safe decompression of the divers, which are as follows:

- Phase A – transfer of the divers into the HRU and make it ready for launch (with a maximum time to undertake this – 15 minutes);
- Phase B – the launch of the HRU and for it to be 100 m clear of the vessel/installation being evacuated (with a maximum time to undertake this – 30 minutes – the time starting when the instruction to launch the HRU is given);
- Phase C – the transit of the HRU to the reception site
- The time taken to get the HRU to a safe haven should be as soon as possible and planning should be based on arrival at the safe haven within 75% of the HRU designed endurance
- The safe haven is where the HRU arrives on completion of transit. This can be the reception site, or the point at which the HRU is loaded onto transport and taken to the reception site;
- Phase D – safe decompression of the divers
- The reception site is where the HRU will be taken for the safe decompression of the divers to be completed. The site can be the location for the LSP where the decompression can be carried out (or completed) in the HRU using the LSP or transfer into a portable HRF (which system is in place will have been agreed by the client) or a permanent HRF.

A vessel with a single HRU should, when alongside a fixed or floating structure, barge, vessel or in port, not be positioned with the HRU such that it may get damaged or cannot be launched when required.

8.4 Evacuation Planning, Procedures and Equipment

The decision to decompress the divers in the HRU using an LSP or providing an HRF into which the divers can be transferred, decompressed and receive medical treatment should be based on a risk assessment directly involving the client. The items to be considered are amongst others:

- working/storage depth;
- prevailing weather and sea conditions;
- distance and duration to a safe haven/reception site;
- HRC or SPHL;
- medical aspects during transit and anticipated medical treatment requirements.

As part of the planning the availability and level of support should be ascertained, which can be provided by the client or others near the location where the saturation diving work is going to take place (see also section 3.2).

Each saturation system should have project specific hyperbaric evacuation and rescue plans and procedures, which have been risk assessed, for the location(s) and water depth where the work is planned to be carried out.

Guidance on the elements to be considered for the planning and execution of a hyperbaric evacuation and subsequent decompression, including, training and risk assessment can be found in IMCA D 052.

The HRU, LSP and HRF will need to comply with the requirements in IMCA D 053 and IMO Guidelines and Specifications for Hyperbaric Evacuation Systems Resolution A.692(17) (see also section 4.9).

All equipment and the documentation required for the efficient management of hyperbaric evacuations should be risk assessed and audited.

8.5 Accelerated Emergency Decompression from Saturation

There may be circumstances where the HRU is out of action, the weather conditions may prohibit launch of the HRU or the planned reception facilities may be not available. In any of those circumstances emergency decompression from saturation may offer the best opportunity of the diver's survival. DMAC guidance on emergency decompression is available (*Ref. DMAC 31*).

9 Emergency Response and Contingency Plans

9.1 Diving Emergencies

The diving contractor's operations manual should contain a section laying out the actions required of each member of the diving team and personnel that have involvement in the diving project, in the event of a foreseeable emergency occurring during operations *(Ref. IMCA C 013)*. It should also identify the diving medical doctor(s) and medical treatment facilities which are available 24 hours per day.

The following list, which is not exhaustive, identifies the type of possible emergencies to be considered:

- dealing with an injured or unconscious diver;
- fire in a chamber or around the dive system;
- evacuation from a vessel or fixed/floating structure which is on fire or sinking;
- loss of pressure in chambers or bell;
- faulty or broken equipment;
- approach of severe weather;
- dealing with decompression illness;
- diving in contaminated waters.

9.2 Lost Bell/Emergency Bell Recovery Contingency Plan

A contingency plan and appropriate procedures, which have been risk assessed, should be in place. These plans/procedures should include the equipment and personnel required to locate and rescue a lost closed diving bell and also the plans/procedures for a closed bell, which is still attached to the vessel/fixed/floating structure, but which is severed from its main lift wire and/or umbilical. These plans/procedures should identify the actions required by the diving contractor and other personnel, and the provision of specific equipment, such as locators (*Ref. AODC 009, AODC 012, AODC 061, AODC 019, IMCA D 017, IMCA D 024*).

The bell needs to be capable of sustaining the lives of trapped divers for at least 24 hours.

9.3 Habitats

A contingency plan and appropriate procedures, which have been risk assessed, should be in place and include the equipment and personnel required for recovery of divers when they are trapped in a habitat.

For an emergency situation the habitat needs to be capable of sustaining the lives of the trapped divers for at least 48 hours.

9.4 Hyperbaric Evacuation

9.4.1 General

In an emergency there needs to be appropriate arrangements in place to evacuate all divers under pressure to a safe place.

9.4.2 Surface Supplied Diving

A contingency plan and appropriate procedures for the location and depth where the work is carried out, which have been risk assessed, should be in place. These should include:

- the personnel and equipment required for the evacuation of a surface supplied diver from a stricken vessel or fixed/floating structure with omitted decompression;
- a chamber for recompression and medical treatment (see also section 4.14);

- the method of evacuation of the diver (with adequate oxygen and medical supplies during transit) to the designated chamber identified for recompression;
- suitable medical doctor(s) available with the necessary knowledge to advise on suitable treatment of divers (*Ref. DMAC 17*);
- minimum required medical equipment (*Ref. DMAC 15*);
- facilities for direct communication with a suitable medical doctor by the diving supervisor, when required;
- emergency decompression tables and procedures.

9.4.3 Saturation Diving

9.4.3.1 Hyperbaric Evacuation

Equipment, plans and procedures for hyperbaric evacuation should be in place and risk assessed for the location and depth where the work is carried out (see section 8).

9.4.3.2 Treatment Inside a Saturation Chamber

In addition contingency plans and procedures for treatment of divers in the chamber, for the location where the work is carried out and which have been risk assessed, should be in place. These should include:

- suitable medical doctor(s) available with the necessary knowledge to advise on suitable treatment of divers (*Ref. DMAC 17*);
- suitable medical treatment arrangements and facilities in the chamber (*Ref. DMAC 28*);
- provision of suitable medical doctors for treatment of diver(s) in the chamber;
- minimum required medical equipment (*Ref. DMAC 15*);
- facilities for direct communication with a suitable medical doctor by the diving supervisor, when required;
- emergency decompression tables and procedures (*Ref. DMAC 31*).

9.5 Emergency Training

The diving contractor should develop generic emergency training scenarios and procedures. Trials should be carried out regularly to train personnel and to test the adequacy of the procedures, interfaces, communications and equipment.

IMCA guidance exists on first aid and other emergency drills (*Ref. IMCA C 013*).

9.6 Diving Contractor's Contingency Centre

While in operation, the diving contractor should maintain, in immediate readiness, a contingency room with adequate communications facilities, all relevant documentation and other necessary facilities for the contingency team, in case of an emergency.

10 Documentation/Audits

10.1 Diving Project Plan (DPP)

Before any diving is carried out there needs to be a diving project plan (DPP) in place. See section 7.1 for a list of documents and procedures it should as a minimum contain.

10.2 Project Safety Management Systems (SMS) Interface Documents

Prior to commencement of the project a project safety management system (SMS) interface document should be in place, which reflects and defines the safety management interface between client, diving contractor, sub-contractors and third parties. The SMS document, which forms part of the DPP, should be prepared by the diving contractor. The document should include but not be limited to:

- project title and revision status;
- circulation list and authorisation signatures;
- project overview and applicable operational work procedures;
- organisation and responsibilities;
- risk evaluation and management of change process;
- SIMOPS;
- monitoring performance/work control system;
- SMS interfacing matrix showing activity/task, responsible parties and controlling documents of relevant parties;
- permit to work systems for intended work;
- field logistics and support;
- helicopter operations;
- operational and emergency communications and contact numbers onshore and offshore;
- accident/incident and near miss reporting and follow-up;
- medevac arrangements;
- hyperbaric evacuation arrangements;
- environmental management including waste management and spills & solid materials loss or dumping;
- emergency response and assignment of primacy;
- flowcharts showing emergency and environmental response.

10.3 Adverse Weather Working Policy

The diving contractor should have guidelines and weather limits for working in adverse weather, written relative to the capability of the vessel or floating/fixed structure.

10.4 Risk Management Process

A risk management process should be in place (see also section 7.2), including a risk management process matrix. This matrix should include the risk identification and management at all stages of the project, the personnel to be involved and the responsible person(s). Part of the risk management process is management of change (*Ref. IMCA S&L 001*).

10.5 Risk Assessment

10.5.1 Safety Risk Assessment

A risk assessment should include the initial risk evaluation and risk level (e.g. high, medium, low) and, if required, further risk reducing measures to bring the residual risk level to as low as reasonably practicable (ALARP). Based on the risk assessment the decision on whether the work can go ahead safely and what precautions need to be taken can be made. The risk assessment should also identify onshore/offshore personnel responsible for ensuring the precautions agreed during the risk assessment are carried out (*Ref. IMCA D 022, information note IMCA SEL 10/08*).

10.5.2 Health and Security Risks

In addition to safety risks personnel may be exposed to other risks depending where the work is carried out. They include health and security risks. Diving contractors should risk assess these, develop procedures and take the necessary precautions.

IMCA guidance is available on threat risk assessment (*Ref. IMCA SEL 018*) and on travel security (*Ref. IMCA SEL 014*).

10.6 Auditing/HAZOP/FMEA and FMECA

10.6.1 Diving Contractor

Each diving contractor should have a process, using a competent auditor, in place for self-auditing of their diving systems and equipment, including hyperbaric rescue equipment, in accordance with IMCA guidelines *(Ref. IMCA D 011, IMCA D 024, IMCA D 052, IMCA D 053).*

DP systems, vessels and ROV systems should also be audited in accordance with IMCA guidelines.

Furthermore, a systematic review of the diving system and its sub-systems should be carried out. This should take the form of a formal risk assessment, which may consist of a detailed risk assessment, HAZOP or an FMEA, to provide a systematic assessment for the identification of potential failure modes and to determine their effects and to identify actions to mitigate the failures (see also section 4.5.2).

The assessment should ensure that failure of a single component should not lead to a dangerous situation.

For complex diving systems an appropriate failure mode effects and criticality analysis (FMECA) should be considered (see also section 4.5.3).

10.6.2 Competence of Auditors

Any auditor undertaking audits of diving contractors should meet the competence requirements in information note IMCA D 07/13.

Two types of auditor have been identified in the information note:

- DESIGN – type audit of the dive system;
- safety management/company audit of diving contractor.

10.7 Management of Change

Each diving contractor should have in place a management of change procedure which describes what actions need to be taken if there is a need to revise an existing approved design, fabrication or work/ installation procedure and how to manage change associated with unplanned events that may arise during the offshore works.

A documented formal review of the change should take place to ensure that safety is not compromised.

When an offshore risk assessment is required senior personnel – typically the diving superintendent/ offshore manager, vessel master, diving supervisor, project engineer and client – should carry out this risk assessment. The contractor's management of change procedure needs to describe clearly the process to be followed for any revision or change, including the requirement for offshore and onshore reviews, risk assessments and who needs to give approval offshore and onshore both from the contractor and the client (see also section 7.2) (*Ref. IMCA S&L 001*).

10.8 Reporting and Investigation of Incidents

In order to learn from near-misses and accidents/incidents, to prevent them from happening again, diving contractors should have a procedure in place for reporting and investigating these. The findings of these investigations should allow the contractor to take the appropriate corrective actions (*Ref. IMCA SEL 016*).

IMCA operates an anonymised safety flash system for the dissemination of information on incidents and the lessons learnt from them.

10.9 Equipment Certification/Classification and Planned and Periodic Maintenance

10.9.1 Certification

Guidance exists on the frequency and extent of inspection and testing required of all items of equipment used in a diving project, together with the levels of competence required of those carrying out the work (*Ref. IMCA D 018, IMCA D 004*). All of the equipment used in a diving operation will need to comply with at least these requirements.

In addition to the equipment and plant certification mentioned above, portable diving systems and fixed diving systems should also comply with applicable national regulations/standards, IMO and flag state requirements.

Suitable certificates (or copies) issued by a competent person will need to be provided at the worksite for checking.

10.9.2 Classification

Diving equipment, located on vessels, built in accordance with a classification society's rules, may, at the owner's request be assigned a class. Classification will normally continue as long as the equipment is found, upon examination at the prescribed surveys, to be maintained in accordance with the society's own rules.

When diving equipment is built to a classification society's rule, maintenance of class is often conditional upon compliance with any relevant statutory requirements of the national authority of the country in which, or the flag state of the vessel or floating installation on which, the diving equipment is installed.

10.9.3 Maintenance

Diving equipment is used under offshore conditions, including frequent immersion in salt water. It therefore requires regular inspection, maintenance and testing to ensure it is fit for use, e.g. that it is not damaged or suffering from deterioration. Regular maintenance is an important factor in ensuring the safe operation of a diving system.

Diving contractors should give due consideration to recommendations given in manufacturers' maintenance manuals, amount of use, previous operational experience and guidance given in IMCA D 018 and IMCA D 004.

Special attention is required when PLCs are used in the diving equipment, including the launch and recovery systems. It is essential that the operation and failure modes are fully understood and risks these systems may introduce during maintenance should be risk assessed (*Ref. information note IMCA M 15/12, information note IMCA SEL 9/12*) (see also section 4.5.4).

10.9.4 Use of Diving Equipment Checklists

Many complex action sequences are required during diving plant and equipment testing and maintenance and there is a risk that steps may be omitted or undertaken out of sequence. A suitable way to ensure the thoroughness of such sequences on each occasion is the use of pre-prepared checklists that require the relevant personnel to tick a box to demonstrate correct completion.

Diving contractors will need to prepare and authorize the use of such checklists. A typical equipment check is described below in outline format.

10.9.5 Pre- and Post-Dive Checks

Prior to diving commencing and after diving has been completed, a series of simple tests and examinations should be carried out by a competent person to confirm that equipment is in good condition. These checks should include:

- a brief visual and touch inspection prior to any power being turned on;
- examination of the system for cracks and dents, loose parts, unsecured wires or hoses, oil spots, discolouration, dirty camera lens, etc.;
- brief operation of each function to ensure proper response;
- loose bolts or couplings should be tightened or, if necessary, replaced;
- all mechanical parts should be kept clean and lubricated;
- areas of potential corrosion should be examined, and any necessary preventative or corrective measures undertaken;
- major mechanical components should be regularly checked for alignment and abrasion;
- the handling system should be checked for structural damage;
- electrical lines and connections should be examined, and any hydraulic system inspected for leaks, abrasions and oil leaks. Fluid levels should be regularly checked;
- a function test should be performed on all brakes and latches.

10.10 Spare Parts

Diving operations are often undertaken in remote offshore areas. Diving contractors should therefore ensure that an adequate serviceable supply of spare items is available, particularly for those items which are essential to continued operation and safety (see also section 4.15.2).

Documents should be in place showing the items in stock, minimum stock levels and items on order.

10.11 Equipment and Certificate Register

An equipment register will need to be maintained at the worksite, with copies of all relevant certificates of examination and test as well as design specifications and calculations of the equipment (see also section 4.15.3).

10.12 Operating Procedures

The operating procedures need to consist of a diving contractor's standard operating rules and any site-specific risk assessments and procedures. The procedures should cover the general principles of the diving techniques as well as the needs of the particular operation. They will also need to provide contingency procedures for any foreseeable emergency (see also section 9).

The management of a project should be clearly specified together with a defined chain of command (see also section 10.2).

Many factors need to be considered when preparing the procedures for a specific project. A risk assessment will need to identify site-specific hazards and their risks. Based on this information, the procedures will then need to state how these hazards and risks can be controlled. An exhaustive list of hazards and risks is not possible, but some are highlighted in the previous sections (see also section 7.1).

10.13 Manuals and Documentation

A major factor in a safe and efficient diving operation is the supply of a comprehensive set of manuals, checklists and logbooks appropriate to the operation. It is the responsibility of every contractor to ensure that each diving system is supplied with the necessary documentation including at least the following:

- contractor's operations manual;
- system equipment technical manuals;
- daily diary/report book;
- planned maintenance system;
- repair and maintenance record;
- systems spares inventory;
- pre-/post-dive checklist.

10.13.1 Area of Operation Legislation and Advisory Publications

Diving contractors should be familiar with all relevant legislation for the areas in which they are operating and the various advisory publications relevant to diving operations. Some examples of the latter are listed in section 11.

10.14 Diving Operations Log

Diving contractors should ensure that a written or electronic record is kept on a daily basis of all the activities carried out and of any other relevant factors.

There is no specific format that this document should take. However, the following is the minimum information which should be recorded:

1) name and address of the diving contractor;
2) date to which entry relates (an entry must be completed daily by each supervisor for each diving operation);
3) location of the diving operation, including the name of any vessel or installation from which diving is taking place;
4) name of the supervisor making the entry and date on which the entry is made;
5) names of all those taking part in the diving operation as divers or other members of the dive team;
6) any codes of practice which apply to the diving operation;
7) purpose of the diving operation;
8) breathing apparatus and breathing mixture used by each diver in the diving operation;
9) bail-out pressure and content;
10) decompression schedule containing details of the pressures (or depths) and the duration of time spent by divers at those pressures (or depths) during decompression;
11) emergency support arrangements;
12) maximum depth which each diver reached;

13) times at which the divers leave atmospheric pressure and return to atmospheric pressure plus their bottom times;

14) any emergency or incident of special note which occurred during the diving operation, including details of any decompression illness and the treatment given;

15) any defect recorded in the functioning of any plant used in the diving operation;

16) particulars of any relevant environmental factors during the operation such as partial pressure of oxygen, CO_2, water temperature as appropriate;

17) toolbox meetings and job safety analyses carried out;

18) management of change applied offshore to revise a procedure;

19) near-miss and incident reporting;

20) any other factors likely to affect the safety or health of any persons engaged in the operation.

10.15 Divers' Personal Logbooks

Divers need to keep a detailed daily record of any dives they have carried out. There are various hard bound logbooks available for this purpose, including those published by IMCA. The following is the minimum information which needs to be entered in the diver's logbook:

1) name of diver;

2) the name and address of the diving contractor;

3) the date to which the entry relates (an entry must be completed daily for each dive carried out by the diver);

4) the name or other designation and the location of the installation, worksite, craft or other place from which the diving operation was carried out;

5) the name of the supervisor who was in control of a diving operation in which the diver took part;

6) the maximum depth reached on each occasion;

7) the time the diver left the surface, the bottom time, and the time the diver reached the surface on each occasion;

8) where the dive includes time spent in a compression chamber, details of any time spent outside the chamber at a different pressure;

9) the type of breathing apparatus and mixture used by the diver;

10) any work done by the diver on each occasion, and the equipment (including any tools) used in that work;

11) any decompression schedules followed by the diver on each occasion;

12) any decompression illness, discomfort or injury suffered by the diver;

13) any other factor relevant to the diver's safety or health;

14) any emergency or incident of special note which occurred during the dive.

The entry must be dated and signed by the diver and countersigned by the supervisor.

11 Bibliography/References

The following is a list of documents which give more detailed information on subjects covered in this code.

Further details on all IMCA/AODC/DMAC publications and their latest revisions are available from IMCA (www.imca-int.com). They are available as free downloads, except for information notes which are available for members only. DMAC publications are also available as free downloads from www.dmac-diving.org and the IMCA website.

IMCA publications issued under AODC:

AODC 009	Emergency isolation of gas circuits in the event of a ruptured bell umbilical
AODC 010	Gas cylinders used in conjunction with diving operations in areas governed by UK regulations
AODC 012	Bell emergency location equipment trials
AODC 019	Emergency procedures – provisions to be included for diving bell recovery
AODC 032	Remotely operated vehicle intervention during diving operations
AODC 034	Diving when there is poor surface visibility
AODC 038	Guidance note on the use of inert gases
AODC 047	The effects of underwater currents on divers' performance and safety
AODC 054	Prevention of explosions during battery charging in relation to diving systems
AODC 055	Protection of water intake points for diver safety
AODC 061	Bell ballast release systems and buoyant ascent in offshore diving operations

IMCA Diving Division publications:

IMCA D 001	Dive technician competence and training
IMCA D 002	Battery packs in pressure housings
IMCA D 003	Guidelines for oxy-arc cutting
IMCA D 004	The initial and periodic examination, testing and certification of hyperbaric evacuation launch systems
IMCA D 006	Diving operations in the vicinity of pipelines
IMCA D 007	Overboard scaffolding operations and their effect on diving safety
IMCA D 009	Protective guarding of gas cylinder transport containers (quads)
IMCA D 010	Diving operations from vessels operating in dynamically positioned mode
IMCA D 011	Annual auditing of diving systems
IMCA D 012	Stainless steel in oxygen systems
IMCA D 013	IMCA offshore diving supervisor and life support technician schemes
IMCA D 015	Mobile/portable surface supplied systems
IMCA D 016	Underwater air lift bags
IMCA D 017	Lost bell survival
IMCA D 018	Code of practice on the initial and periodic examination, testing and certification of diving plant and equipment
IMCA D 019	Diving operations in support of intervention on wellheads and subsea facilities
IMCA D 020	IMCA Scheme for Recognition of Diver Medic Training – Guidance for training establishments
IMCA D 021	Diving in contaminated waters
IMCA D 022	The Diving Supervisor's Manual
IMCA D 023	DESIGN – Diving equipment systems inspection guidance note for surface orientated (air) systems
IMCA D 024	DESIGN for saturation (bell) diving systems

IMCA D 025	Evacuation of divers from installations
IMCA D 027	Marking of hyperbaric rescue systems designed to float in water
IMCA D 028	Guidance on the use of chain lever hoists in the offshore subsea environment
IMCA D 030	Surface supplied mixed gas diving operations
IMCA D 031	Cleaning for oxygen service: Setting up facilities and procedures
IMCA D 033	Limitations in the use of SCUBA offshore
IMCA D 035	The selection of vessels of opportunity for diving operations
IMCA D 037	DESIGN for surface supplied mixed gas diving systems
IMCA D 039	FMEA guide for diving systems
IMCA D 040	DESIGN for mobile/portable surface supplied diving systems
IMCA D 041	Use of battery operated equipment in hyperbaric conditions
IMCA D 042	Diver and ROV based concrete mattress handling, deployment, installation, repositioning and decommissioning
IMCA D 043	Marking and colour coding of gas cylinders, quads and banks for diving applications
IMCA D 044	Isolation and intervention: Diver access to subsea systems
IMCA D 045	Code of practice for the safe use of electricity under water
IMCA D 046	Guidance on operational communications
IMCA D 048	Surface supplied diving operations using nitrox
IMCA D 049	Code of practice for the use of high pressure jetting equipment by divers
IMCA D 050	Minimum quantities of gas required offshore
IMCA D 051	Hyperbaric evacuation systems (HES) interface recommendations
IMCA D 052	Guidance on hyperbaric evacuation systems
IMCA D 053	DESIGN for hyperbaric evacuation systems

IMCA Diving Division information notes:

IMCA D 02/06	The evaluation and testing of the environmental control of hyperbaric evacuation systems
IMCA D 13/06	Diving cylinder threads and wall thickness
IMCA D 03/11	Whip checks
IMCA D 04/11	Divers' gas supply
IMCA D 04/12	Surface swimmers
IMCA D 05/13	Changes to diver medical validity period
IMCA D 07/13	Competence of auditors
IMCA D 11/13	Diver and diving supervisor certification

IMCA Marine Division publications (including those issued under DPVOA):

IMCA M 103	Guidelines for the design and operation of dynamically positioned vessels
113 IMO	Guidelines for vessels with dynamic positioning systems (MSC Circular 645)
115 DPVOA	Risk analysis of collision of dynamically positioned support vessels with offshore installations (revised)
IMCA M 117	The training and experience of key DP personnel
121 DPVOA	DP position loss risks in shallow water
127 DPVOA	Guidelines to the issue of a flag state verification acceptance document
IMCA M 140	Specification for DP capability plots
IMCA M 149	Common Marine Inspection Document

IMCA M 166	Guidance on failure modes and effects analyses (FMEAs)
IMCA M 178	FMEA management guide
IMCA M 189	Marine inspection for small workboats (Common marine inspection document for small workboats)
IMCA M 190	Guidance for developing and conducting annual DP trials programmes for DP vessels
IMCA M 194	Guidance on wire rope integrity management for vessels in the offshore industry
IMCA M 203	Guidance on simultaneous operations (SIMOPS)
IMCA M 204	Vessel assurance
IMCA M 205	Guidance on operational communications
IMCA M 206	A guide to DP electrical power and control systems
IMCA M 212	Example of an annual DP trials report

IMCA Marine Division information notes:

IMCA M 15/12	Programmable logic controllers (PLCs)

IMCA Remote Systems & ROV Division publication:

IMCA R 004	Code of practice for the safe and efficient operation of remotely operated vehicles

IMCA Safety, Environment & Legislation (SEL) publications:

IMCA S&L 001	Guidance for the management of change in the offshore environment
IMCA SEL 014	Guidance on travel security
IMCA SEL 016	Guidance on the investigation and reporting of incidents
IMCA SEL 018	Threat risk assessment procedure
IMCA SEL 022	Guidance on wire rope integrity management for vessels in the offshore industry
IMCA SEL 024	Guidance on handling naturally occurring radioactive material

IMCA Safety, Environment & Legislation (SEL) information notes:

IMCA SEL 10/8	Risk assessment matrices – a brief overview
IMCA SEL 9/12	Programmable logic controllers(PLCs)

IMCA Competence & Training publications:

IMCA C 002	Guidance document and competence tables: Marine Division
IMCA C 003	Guidance document and competence tables: Diving Division
IMCA C 011	Outline syllabus for training of personnel in supervisory positions
IMCA C 013	First aid and other emergency drills
IMCA C 014	Guidance on the use of simulators

IMCA Competence and Training information notes:

IMCA TCPC 12/04	Competence of client representatives

Publications of the Diving Medical Advisory Committee (DMAC):

DMAC 01	Aide mémoire for recording and transmission of medical data to shore
DMAC 02	In water diver monitoring
DMAC 03	Accidents with high pressure water jets
DMAC 04	Recommendations on partial pressure of O_2 in bail-out bottles
DMAC 05	Recommendation on minimum level of O_2 in helium supplied offshore

DMAC 06	The effect of sonar transmissions on commercial diving activities
DMAC 07	Recommendations for flying after diving
DMAC 11	Provision of first aid and the training of divers, supervisors and members of dive teams in first aid
DMAC 12	Safe diving distance from seismic surveying operations
DMAC 13	Guidance on assessing fitness to return to diving after decompression illness
DMAC 15	Medical equipment to be held at the site of an offshore diving operation
DMAC 17	The training and refresher training of doctors involved in the examination and treatment of professional divers
DMAC 20	Duration of bell lockouts
DMAC 21	Guidance on the duration of saturation exposures and surface intervals between saturations
DMAC 22	Proximity to a recompression chamber after surfacing
DMAC 26	Saturation diving chamber hygiene
DMAC 28	The provision of emergency medical care for divers in saturation
DMAC 29	Approval of Diving Medicine Courses
DMAC 31	Accelerated emergency decompression from saturation

International Maritime Organization (IMO) documents related to diving operations:

IMO Resolution A.831(19)	IMO code of safety for diving systems
IMO Resolution A.692(17)	IMO guidelines and specifications for hyperbaric evacuation systems
IMO MSC/Circ.645	Guidelines for vessels with dynamic positioning systems

References – International Association of Oil & Gas Producers (OGP) documents related to diving operations:

Report No. 6.36/210	E&P Forum Guidelines for the Development and Application of Health, Safety and Environmental Management Systems
Report No. 411	Diving Recommended Practice
Report No. 412	Guidelines for the management of Naturally Occurring Radioactive Material in the oil and gas industry
Report No 431	Diving Worksite Representative roles, responsibilities and training
Report No. 471	Oxy-Arc underwater cutting Recommended Practice
Report No. TBA	Saturation Diving Emergency Hyperbaric Rescue Performance requirements

12 Country-Specific Appendices

The following country specific appendices are currently in place:

IMCA D 06/13 – Gulf of Mexico Annex

IMCA D 13/07 – Middle East Appendix

IMCA D 14/07 – UK Appendix

Diving Management System (DMS)

The DMS should include as a minimum the subjects mentioned below *(see also sections 1.6 and 3.1)*.

Item	**Subject**
1.	**Contractor HSSEQ Policy and Objectives**
2.	**Organisation, Resources and Documentation**
2.1	Organisational structure and roles and responsibilities
2.2	Communications procedures
2.3	Personnel selection, training, competence assessment and induction procedures
2.4	High voltage training and procedures
2.5	Environmental awareness training of personnel
2.6	Documentation and controls procedures
2.7	Handover procedures
2.8	Drugs and alcohol policies and procedures
3.	**Evaluation and Risk Management**
3.1	Health risk assessment and management procedures
3.2	Safety risk management procedures including HIRA, JSA and toolbox talk procedures
3.3	Security risk assessment and procedures including: ♦ Travel security ♦ Threat risk assessment and management
3.4	Environmental risk assessment and procedures
3.5	Management of change procedures
4.	**Planning**
4.1	Diving operations procedures and manuals
4.2	Maintenance and minimum spares procedures
4.3	Equipment register
4.4	Work procedures and plans
4.5	Vessel management procedures/ISM Code/ISPS Code
4.6	Quality control procedures
4.7	Environmental management procedures including: ♦ Waste management ♦ Prevention of release of harmful substances or materials into the environment
4.8	Environmental spills & solid materials loss contingency procedures and plans
4.9	Emergency and contingency procedures and plans
5.	**Implementation and Monitoring**
5.1	Monitoring procedures
5.2	Non-compliance and corrective action monitoring
5.3	Near miss-, incident/accident reporting, investigation and follow-up procedures
6.	**Auditing and Reviewing**
6.1	Auditing and self-auditing procedures
6.2	Review of activities and performance procedures
6.3	Implementation lessons learned procedures

Maximum Bottom Time Limitation

Maximum bottom time limitations for surface decompression (SD), in-water decompression and transfer under pressure (TUP) decompression diving (see also section 7.3.4).

Depth		Bottom Time* Limits (minutes)	
Metres	**Feet**	**TUP**	**SD and in water**
0-12	0-40	240	240
15	50	240	180
18	60	180	120
21	70	180	90
24	80	180	70
27	90	130	60
30	100	110	50
33	110	95	40
36	120	85	35
39	130	75	30
42	140	65	30
45	150	60	25
48	160	55	25
51	170	50	20

* Bottom time is the total elapsed time from when the diver is first exposed to a pressure greater than atmospheric i.e. (a) when leaving the surface with an open device; (b) on the start of pressurisation when a closed device is employed in the observation mode, to the time (next whole minute) that the diver begins decompression (measured in minutes).